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ORIGINAL ARTICLES

The Contributions of Physical Therapy to Medicine ..... Frank H. Krusen, M.D. 597

Clinical Aspects of the Reaction of Degeneration ..... J. Fremont Bateman, M.D., and B. Billman, M.D. 603

Treatment of Painful Bursae of the Shoulder ..... A. A. Martucci, M.D. 611
Discussed by Drs. K. G. Hansson, N. E. Titus, Richard Kovács, and John D. Currence.

Fever Therapy in Ocular Diseases ..... J. M. Berris, M.D., and M. K. Newman, M.D. 615

Sterility of Male Animals Induced by Radiant Heat ..... Upton Giles, M.D., A. L. Harvey, B.P.E., A.B., and F. W. Dampere, R.N. 619
Discussed by Drs. C. A. Mills, William Bierman, and Upton Giles.

Physical Therapy and Occupational Therapy in Fractures ..... Harry E. Mock, M.D. 625
Discussed by Drs. Frank H. Krusen and Harry E. Mock, and Miss Henrietta McNary.

Low Voltage Wave Current in Vascular Therapy ..... Ernst Bettmann, M.D. 633

EDITORIALS

Short Wave Diathermy in Gynecology 637

The Seventeenth Annual Meeting 639

Awards of Merit by The American Congress of Physical Therapy 641

Awards to Scientific Exhibitors 641

SPECIAL SECTION

Science, News, Comments 642

THE STUDENT'S LIBRARY

Book Reviews 645

INTERNATIONAL ABSTRACTS

Abstracts from Physical Therapy, X-Ray, Radium, Biophysics 649

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THE CONTRIBUTIONS OF PHYSICAL THERAPY TO MEDICINE *

Section on Physical Therapy The Mayo Clinic

FRANK H. KRUSEN, M.D.

ROCHESTER, MINNESOTA

It is not my purpose this evening to mention the well-known names of the pioneers of our branch of medicine, nor shall I bore you with a recital of the accomplishments of these distinguished men and of their followers, for their momentous contributions to our field are thoroughly familiar to all. Suffice it to say in brief that physical therapy was inaugurated some time prior to the Paleolithic age, probably before the year 4,000 B. C., when prehistoric man utilized sunlight, rubbing and bathing for the relief of his suffering. Through the ages scientific physical therapy developed slowly and did not keep pace with other branches of medicine.

It was not until the last two decades that its development was acceierated. Its recent growth has been most startling. Fifteen years ago one rarely saw any mention of physical therapy in the general medical journals. Today the medical literature abounds with references to the use of physical agents in the treatment of disease. A recent experience gave evidence of the changed attitude of the medical profession toward this subject. As I read the *Journal of the American Medical Association* for April 4, 1936, I was struck with the fact that there were many references to the subject of physical therapy and decided to analyze this issue with regard to these references. I found to my immense satisfaction that reference was made to the subject of physical therapy on twenty-eight of the 147 pages, and that the words "physical therapy" appeared in this one issue no less than seventy-nine times. What more impressive proof could there be of the great interest of the general medical profession in this subject?

Past Contributions

During the past score of years the medical profession has come to realize that not only chemicals, biologic preparations and surgical procedures, but also physical agents, may be of great value in combating disease, relieving suffering and shortening disability. The profession has learned that physical measures may be of immeasurable aid in the rehabilitation of the disabled. Improved knowledge has been gained of the use of thermal agents in the treatment of disease. The pioneer group of physical therapists who have developed fever therapy and short wave diathermy have made vast contributions toward the relief of human suffering.

Physical therapy has contributed many new mechanical procedures for the treatment of disease and has developed innumerable therapeutic applications of light, heat, water and electricity. The work which has been done in the past two decades leaves no room for doubt that physical medicine deserves a place beside general medicine and surgery.

In addition, the workers in this field, many of them members of this Congress, have trained, set standards for, and registered large numbers of skilled technicians to apply physical treatment under medical supervision. The members of this Congress have disseminated reams of information for

* Presidential Address read before the American Congress of Physical Therapy, Chicago, September 12, 1938.

general practitioners, and the Council on Physical Therapy of the American Medical Association has done much to standardize the work in this field.

The Archives of Physical Therapy, under the able editorship of Dr. Kobak, has served as a constant source of reliable information on physical therapy for medical practitioners. But, despite these valuable contributions, our field is still new and there is a great need for further development of our work.

The Physical Therapist and the Medical Profession

As pioneers in a new field of medicine, we have had to contend with ultraconservative physicians who doubted each of our forward steps. Weir Mitchell told the story of the old professor of obstetrics at the Jefferson Medical College, Ellersly Wallace, who, in the early days of anesthetics, decried their use in obstetrics. To prove that ether was extremely dangerous, he brought before his class a goat which he proceeded to anesthetize. The goat soon became apparently lifeless and was removed from the lecture room by an assistant while Wallace continued to expound on the dangers of anesthesia as exemplified by the demise of the goat. His object lesson, however, proved to be a boomerang, for just as he completed his lecture the class was startled by loud baas emanating from the adjoining room.

In a similar manner, certain members of the medical profession have been embarrassed by the success of innovations in physical therapy of which they at first disapproved. All of us who have championed this field of medicine may take comfort in the quotation from Elbert Hubbard that, "A man is generally down on that on which he is not up." A physician may inquire how many of the elaborate devices which we employ in physical therapy are discarded after a few months. He does not seem to realize that we strive to employ the simpler physical procedures whenever it is feasible and do not use complicated apparatus until it has been carefully tested and has proved its value. The orthopedist, for example, might be asked how many of the elaborate surgical instruments which he employed in orthopedics were discarded after a few months. A good orthopedist uses all of the intricate devices he may require after carefully checking them. It is true that he can do much of his work with a scalpel and a few hemostats; nevertheless, he can and does use many elaborate instruments to great advantage.

Similarly, the physical therapist can do much of his work with the aid of a simple luminous heater and some massage, but he can and does use many more complex devices and measures to great advantage.

Part of our contribution should be to face with patience and understanding the lack of information of our colleagues concerning our work. We know that the continued rapid growth of physical therapy is assured and we can afford to wait until it is better understood. We know that until recently the subject has been inadequately taught in our medical schools and our colleagues cannot be expected to know much about it. Thus, according to Elbert Hubbard, they may be down on it. We should ignore unwarranted criticism or attempt to promote understanding which will prevent it. On the other hand, it is our obligation to face constructive criticism squarely, to welcome it, and to make every effort to profit by it and thus to improve our work. It is undoubtedly true that the development of physical therapy to date has been far from perfect and that many of the criticisms of it have been justified. Yet, in recent years few branches of medicine have made such generally rapid strides or forged more effective weapons to combat disease.

Suggestions for Improving Our Contributions

It behooves us, however, not to rest on past laurels but to inquire as to how we may further advance our contributions to medicine.

Avoidance of the Spectacular. — First and foremost, I would say that we should be scrupulous in the avoidance of that which is overly imposing. In a recent publication,[1] Dr. William J. Mayo wrote of his experiences in the early part of this century with an electrical machine which he and his brother, Dr. Charles H. Mayo, had acquired. He said:

> I remember well that Dr. Charlie and I had been greatly impressed with the x-ray and such related mechanisms as were available at that early date, and we had acquired a rather imposing electrical machine. No one knew just what it could or would do or what was expected of it, but it was thought at least to have some important diagnostic value. Unfortunately, machines of this type were sometimes being used by charlatans to impress patients, especially those classified as "neurotic." Dr. Charlie and I always had a fear of falling into the easy way, unconsciously though it might be, of impressing patients and for that reason we had all the connections of the machine which could be used for spectacular action pulled out and replaced with wooden pegs.

I believe that these beloved medical leaders, with their usual wisdom, sounded the keynote which should set the tone of the actions of all physicians who are interested in physical therapy. We should make it a definite practice to avoid falling into the easy way of impressing patients and we should follow the example of the Drs. Mayo and from such machines we should have all connections which may be used simply for spectacular action, pulled out and replaced with wooden pegs.

While we should not discard an apparatus which may be definitely useful simply because it is spectacular in its construction and action, on the other hand we should minimize the impressive elements of the procedure and shun all sham and pretence.

Avoidance of Half-truths and of Overenthusiasm. — We should scrupulously avoid the utterance of half-truths.

> A lie which is all a lie may be met and fought with outright,
> But a lie which is part a truth is a harder matter to fight.

The more truthful we are about our failures, as well as about our successes, the more rapidly will our work be accepted by even the most conservative of our associates.

We must avoid too much vanity and enthusiasm concerning our attainments. Our greatest efforts to combat sickness and death are at most but frail achievements. Sophocles has said[2] —

> The power of learning may a while prevail,
> A time prolong a mortal's fleeting breath,
> But useless all her arts are to avail
> To conquer Fate or check the hand of Death.

Furtherance of Specialization. — In spite of the fact that many men in this Congress have for years devoted their time exclusively to this field of medicine, some individuals have questioned whether physical therapy could be termed a separate medical specialty. The attitude of those who insist that physical therapy is not a specialty is as fallacious as that of a certain railroad conductor. A professor was waiting at a small station in the rain, when, to his surprise, a through express made an unscheduled stop at the station. To avoid the rain he boarded it instead of waiting for the local. The conductor of the express rushed up and said, "You can't get on this

train because it doesn't stop here." The professor promptly replied, "That's all right, if the train doesn't stop here, then I'm not on it."

We who have boarded the physical therapy specialization train feel very much like the professor, for the fact remains that there are specialists in physical therapy despite what anyone may say to the contrary and, therefore, physical therapy is a specialty.

While it is true that there are many forms of physical therapy which are elaborate and which require highly trained individuals for their administration, there are also many simple physical measures which should be used by all physicians. Though there are specialists in physical therapy, the field should not be confined to them exclusively. On the contrary, every general practitioner should be using many of the simpler physical therapeutic measures in his daily work. Just as the average physician may do his own urinalyses and blood counts but depends on the clinical pathologist for Wassermann reactions and blood chemical studies, so may he use an infra-red lamp or contrast baths in his own office. He may rely on the specialist in physical therapy for the more complicated procedures, such as fever therapy, or corrective exercises. For this reason, every specialist in physical therapy should strive to disseminate every possible bit of information on this subject to all of his fellow practitioners. Only by following such a procedure can he bring the greatest good to the greatest number.

Improvement of Our Literature. — We should be extremely accurate in our written conclusions concerning our work. Too frequently have we jumped to conclusions before we have been sure of our results. We should never advocate the use of a new physical procedure until its efficacy has been thoroughly proved. We should never make positive statements concerning the value of a physical measure until we have conducted carefully controlled studies in a sufficient number of cases to prove our contentions.

Naturally, we physical therapists do have certain weaknesses. One of our greatest shortcomings has been our literature. There is justification in the following criticism leveled at us by the editors of the *Fourth Rheumatism Review*.[3] Before this criticism was written into the review, the chief editor consulted me concerning it and asked my opinion. I told him that I felt that it was justified and urged that he incorporate it in the review. I hope that it will serve to awaken us all to one of our great deficiencies. This is the criticism:

> The editors of the *Reviews* believe clinicians in general will share their disappointment at the inadequacy of most "clinical reports" published in certain special journals on physical therapy. These reports on arthritis rarely contain data on any controls; they make little or no attempt to differentiate the various types of arthritis being treated; if they do, they contain practically no clinical or laboratory data indicating the extent or severity of the disease from which one can base an independent opinion on the value of therapy. As a rule, a few representative "successes" are reported in the most cursory detail. In technical matters they are often excellent; as clinical investigations they are generally very inadequate and disappointing. The variations and vagaries of the arthritides being what they are, it is suggested that specialists in physical therapy team up with clinicians and "rheumatism specialists" to instigate those clinical investigations in physical therapy which are so long overdue.

In reply we might state that while physical therapists may be weak in clinical observation, clinicians may likewise exhibit deficiency in their understanding of physical therapy. The common statement of the clinician, "Give this patient some physiotherapy," conveys no more meaning than if he were to write a prescription to the druggist to give the patient some medicine.

But physical therapists should accept the challenge made in the *Rheumatism Review* and welcome this constructive criticism. We all agree

that there should be greater cooperation between clinicians and physical therapists in the development of proper clinical and therapeutic investigations. I am happy to report that the statement in the *Review* did not go entirely unchallenged, since at least two physical therapists communicated with the editor and offered to coöperate with their colleagues. But let us not pass this criticism by too lightly. We must always keep in mind the necessity of careful scientific clinical investigations in this field. By close coöperation between diagnostician and therapist, each will become more familiar with the other's virtues and, with better understanding, both will be benefited.

Condemnation of Unscientific Literature. — Not only should we combat any tendencies to write unscientific articles but we should also vigorously oppose the presentation of unscientific books. Recently there appeared in our ARCHIVES OF PHYSICAL THERAPY[4] a protest from the author of an especially poorly written book, concerning an unfavorable review which was given it in the ARCHIVES. In reply, the editor wrote that there was "little cause for complaint on the part of the author because, if anything, the reviewer of his book has suppressed a natural desire for condemnation in harsh terms and has presented a criticism tempered with charitable feeling for the author's well-meant but misdirected effort."

The particular book in question was reviewed in the *Journal of the American Medical Association* and an opinion was expressed which might well mirror the attitude of every scientific physical therapist toward poor literature. The reviewer concluded: "It is such unscientific, outmoded presentations which hamper the rapid growth of an extremely important field of medicine. The reading of such books creates in the mind of the average physician an unjustified critical attitude toward the entire field of physical therapy." Our course is extremely clear. We must improve our literary efforts, and we must condemn that part of our literature which is unscientific.

Our Strength

One may turn with confidence from a consideration of our weakness to a study of our strength. It may safely be said that our future development depends on the united effort of all physicians interested in this field. The fact that the Congress has combined its activities with those of various affiliated bodies, on both the east and west coasts, unquestionably has been our greatest bulwark. Our growing potentialities also are based on the fact that the medical profession as a whole has been gradually obtaining a better understanding of our work through the educational activities of this Congress and because of the careful evaluations of the Council on Physical Therapy of the American Medical Association.

Furthermore, recent investigations[6] indicate that physical therapy is gaining greater attention from our medical schools than formerly it had. Although of sixty-six schools questioned, only twenty-two offered required courses in physical therapy in 1931, thirty-one offered such courses in 1936. In 1931 only two schools offered both required and elective courses, whereas in 1936, six schools offered such combination courses. Twenty-five schools offered more nearly complete courses in 1936 than they offered in 1931. Although, largely because of a scarcity of well-trained instructors, there is still room for improvement in undergraduate instruction in physical therapy, nevertheless teaching of our subject in the medical schools is obviously progressing.

Our strength also lies in the fact that there is better cooperation today than ever before between physicians interested in physical therapy and

technical workers in the field. The work of the American Registry of Physical Therapy Technicians, which was organized by this Congress, with the cooperation of the Council on Medical Education and Hospitals of the American Medical Association, has done much to improve the understanding between physician and technician. The number of technicians who attend these meetings of medical physical therapists gives proof of their interest in the great joint problem which faces us.

What better evidence could we have of the coöperation between allied groups than the fact that at this particular session the American Occupational Therapy Association is meeting jointly with us?

Comment and Summary

Our numbers are still small but our future is bright. Our progress depends on united effort toward the promotion of our work. During all of our efforts toward advancement we may well strive to avoid professional or national political entanglements. I believe, as Walter Winchell says, that we should be "as non-political as a pair of socks — neither Left nor Right."

Physical therapy has made great contributions to medicine, particularly during the last two decades. Its possibilities are almost boundless and its destiny in America is for the most part in the hands of the members of this Congress. Let us be loyal to that trust, let us hasten the development of this great field of medicine by being more scientific in our writing, more cooperative with our fellow workers, and utterly honest in our conclusions. We cannot afford to make mistakes and above all, we must be accurate in our writing.

> Of all those arts in which the wise excel,
> Nature's chief masterpiece is writing well.

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CLINICAL ASPECTS OF THE REACTION OF DEGENERATION *

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and

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COLUMBUS, AND CINCINNATI, OHIO

Electrical stimulation of nerves is a very necessary part of the neurological examination both for therapeutic as well as diagnostic purposes. With a comparatively simple technic one can obtain valuable information regarding certain parts of the nervous system by stimulating various motor nerves and recording individual muscle response. Electrical examination very often offers distinct knowledge of certain neurological conditions, without which such information might be only guess work.

As is well known certain nerve fibers have a definite specificity for certain motor and sensory acts. Under normal circumstances a nerve fiber is stimulated at either its central or peripheral end. The nerves carrying impulses from the central nervous system outward are stimulated from within. Those afferent nerves originating in the periphery — skin, muscles, bone, tendon, are stimulated only from without. However, by artificial means a nerve fiber may be stimulated anywhere along its course. There are four groups of artificial stimuli, capable of stimulating a nerve and generating in it a nerve impulse:

1. Mechanical.
2. Thermal.
3. Chemical.
4. Electrical.

Most of them present distinct objections, the least objections, however, being with the electric current. In fact, electric currents when properly used and controlled, most nearly approximate natural physiologic impulses. They are easily applied, can be controlled, and thus affect the entire muscle bundle simultaneously.

Electrodiagnosis

Electrodiagnosis depends upon the fact that under normal conditions a definite muscle response is obtained by stimulating the nerve to that muscle. If through disease or injury the normal muscle response has been changed, then one has a very definite objective means of recording the damage. Much information can be obtained from the ordinary simple perceptive methods of examination; yet, if there is subjective inability to move a certain muscle or muscle group, although the segment by all other means appears normal, then electrodiagnosis offers most valuable concrete information.

The technic of electrodiagnosis is simple and should be used more widely when a lesion of the nervous system is suspected. Much has been written on the subject since it was first introduced by Duchenne nearly a hundred years ago, yet the ordinary textbooks for medical students and practitioners give only a brief discussion of the subject. The average medical school passes over this subject during the clinical years and obviously the students can

* Read at the Sixteenth Annual Session of the American Congress of Physical Therapy, Cincinnati, Ohio, September 22, 1937.

have no appreciation of its value. Electrodiagnosis is not and should not always be conclusive, but with a careful history and complete physical examination much can be learned. Haller and Bernard, the great physiologists who removed the "animal spirits" from the central nervous system, proved that a muscle has the property of contractibility and irritability. Likewise a nerve fiber may be stimulated to its specific properties of irritability and conductivity. During the course of disease these properties may be altered and thereby produce very important symptoms. When a nerve becomes damaged through accident or disease, electrical stimulation may give varied responses. The muscle contraction may be exaggerated, diminished or entirely absent. These variations in excitability are usually easily interpreted since there are two exciting structures, the nerves and the muscle fibers themselves. Through much experimentation it was learned that in the ordinary diseases the excitability of a muscle corresponds to the condition of the motor nerve supplying it. A few exceptions exist and will be discussed later.

In order to properly evaluate the nature and character of muscle response, it is necessary to exercise great care in selecting the motor points. The chances for error are great for subsequent testing unless the motor points are carefully selected and marked. These points are by no means constant and vary in individuals, but are found where the main nerve supply enters the muscle. The accompanying illustration (fig. 1) demonstrates the motor points of one of us, which were carefully worked out over a period of several days.

Fig. 1. — Motor points of flexor region marked off on one of the author's (J. F. B.) upper extremity.

For therapeutic and diagnostic purposes two types of electricity are used, the galvanic and the faradic currents. Stimulation of the motor nerves is demonstrated by contraction of the muscles supplied by them, and the sensory nerves by the subjective sensations obtained. Under normal conditions the faradic current produces a series of isolated shocks with a continuous contraction during its entire flow. When the galvanic current is applied contraction occurs only when the current commences or ceases to flow, that is at the make and break. Although nerve fibers and muscle fibers possess the same property of excitability as other tissues in the body, there is a certain difference in response to various exciting agents. Nerve fibers

are more sensitive to the faradic, while muscle fibers are more easily excited by the galvanic current. The alternating shocks of short duration which characterize the faradic current are incapable of producing a response in the less selective muscle tissue. The galvanic current stimulates a muscle regardless of whether the nerve is intact. Therefore the property of irritability in muscle fibers may be demonstrated best by the galvanic current because it is direct, constant and continuous.

The galvanic current presents a change in polarity — the positive (+) and the negative (—) poles. From a physiologic standpoint the phenomena provoked at the positive pole are vastly different from those of the negative pole. Although these phenomena are for the most part of therapeutic advantage they are in a lesser degree of diagnostic importance. Table 1 briefly summarizes these unusual properties.

TABLE 1. — *Physiologic Properties of the Positive and Negative Poles*

Positive	Negative
Muscular Contraction (less marked).	Muscular Contraction (more marked).
Liberates Oxygen.	Liberates Hydrogen.
Acid.	Alkaline.
H — ion Concentration (increased).	H — ion Concentration (decreased)
Drives in Metals.	Drives in Non-Metals.
Coagulates.	Liquefies.
Vaso-constrictor.	Vaso-dilator.
Decreased Irritability.	Increased Irritability.

Under pathologic conditions when the state of nutrition is impaired, the motor nerve may not respond to stimulation, and the independent property of contraction of the muscle becomes evident. These changes may be summarized as follows (table 2):

TABLE 2. — *Independent Muscle Contraction*

	Quantitative	Qualitative.
Nerve and Muscle intact.	May require from 3-5 ma. to secure minimal contraction.	Quick lightning like contraction.
Nerve impulse not reaching muscle.	May require 12-20 ma. to contraction.	Slow, lazy, longitudinal.

With the galvanic current the question of polarity is important as shown in table 1. Normally the negative pole (cathode) elicits a greater contraction than the positive pole (anode). This is when the current is closed (make). However, when the current is opened (break), the positive pole elicits a greater contraction than the negative pole.

The normal formula, therefore is —

CCC> ACC> AOC> COC>, (figure 2).

Reactions of Degeneration

It is an incontestable fact that when a nerve is cut or injured that the fibers peripheral to the point of injury undergo degeneration. In various pathologic states caused by chemical, mechanical or infectious processes, the state of degeneration may be incomplete. Thus we observe a partial reaction of degeneration — RD by electrodiagnostic methods.

In many pathologic states the reverse of the normal formula may obtain. In the first place faradic irritability may be either lost or an excessive amount of current may be necessary to elicit a mild response. Galvanic irritability may be increased and changed in quality and quantity. Thus the closing contraction may occur at the positive as readily as at the negative pole; and the opening contractions of either pole may appear greater than the closing contractions.

When the changes are quantitative, more or less current than is used under normal conditions is required. With less current there is increased excitability, and with more current decreased excitability.

For practical neurologic purposes lesions of the nervous system may be divided into two types: 1, irritative and 2, destructive lesions. An irritative lesion at some time may become destructive and a destructive lesion may at any time prove a source of irritation. In pathologic conditions producing irritation of the central or peripheral nervous system this quantitative change is manifested by increased irritability. Such conditions as brain tumor, meningo-encephalitis, acute verebral vascular accidents, acute neuritis, and infectious myelitis show this quantitative change.

The following case is that of a physician who suffered from a toxic neuritis, which was secondary to a badly infected tooth. The first examination showed the quantitative change in the left arm, manifested by increased irritability (fig. 2). The left arm was so easily irritated that it required less than one milliampere in both opening and closing contractions to effect a muscle response. Note the normal formula in the right arm.

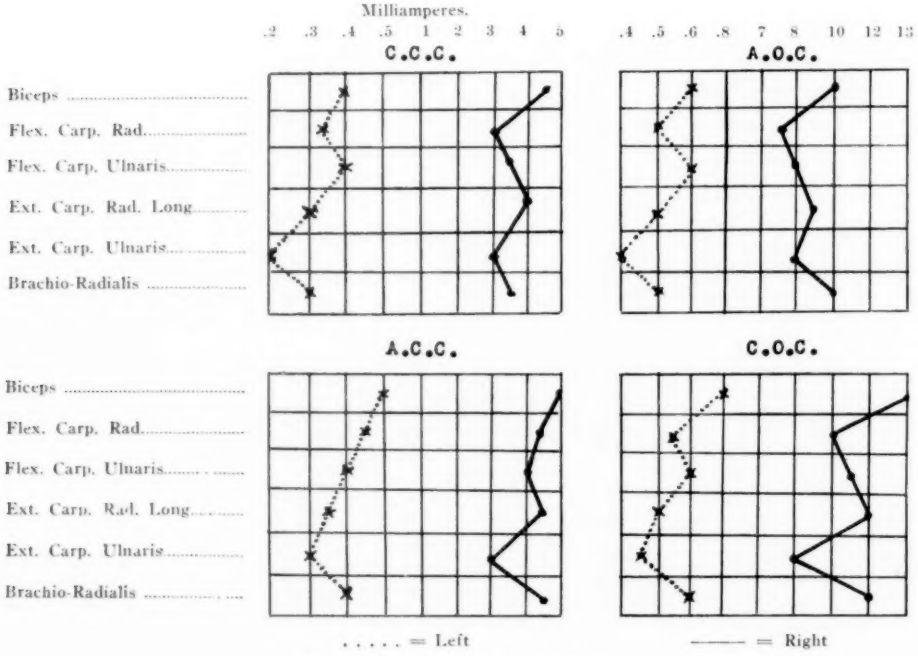

Fig. 2. — Toxic neuritis of left arm.

The second test (fig. 3) taken twelve days later shows a spread of the toxins to the right arm. In this there was a slight polar reversal, in that ACC and AOC are practically the same, and COC shows a marked quantitative change with increased irritability, as compared with the previous chart.

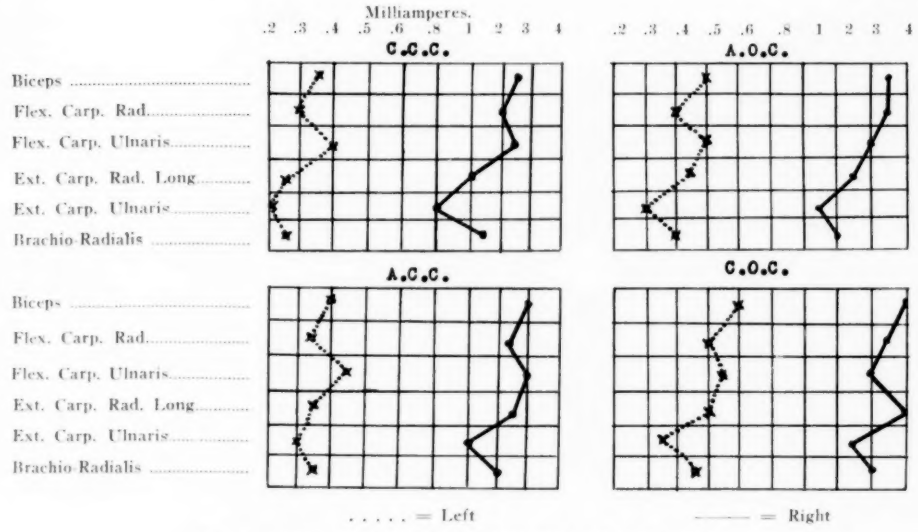

Fig. 3. — Toxic neuritis involving both arms (12 days later).

The third record (fig. 4) made forty days after the removal of the infected tooth, shows a practically normal formula. There is some slight quantitative change remaining at the AOC and the COC particularly of the right arm as compared with figure 1.

In destructive lesions of the nervous system, such as atrophy from chronic poliomyelitis, peripheral neuritis with atrophy and without involvement of the motor cells of origin, tabes, long standing cerebral accidents, and simple muscular atrophy, this quantitative change is noted by an increase in the current required which means that there is diminished excitability of the nerves.

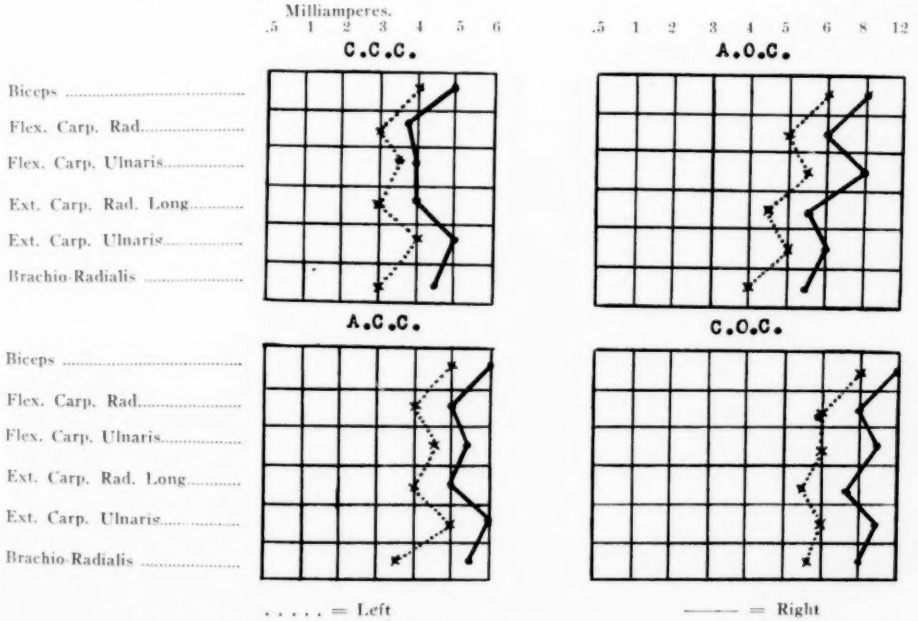

Fig. 4. — Normal response (40 days) after removal of foci of infection.

The following case is illustrative of a destructive lesion of the nervous system which produced diminished excitability.

A white man, 50, with an atypical Duchenne-Erb paralysis due to a meningo-vascular form of cerebro-spinal syphilis. Onset of illness was characterized by certain irritative phenomena of the left arm, various sensory disturbances and at times spasmodic contractions. In spite of active antisyphilitic treatment this lesion became destructive in nature.

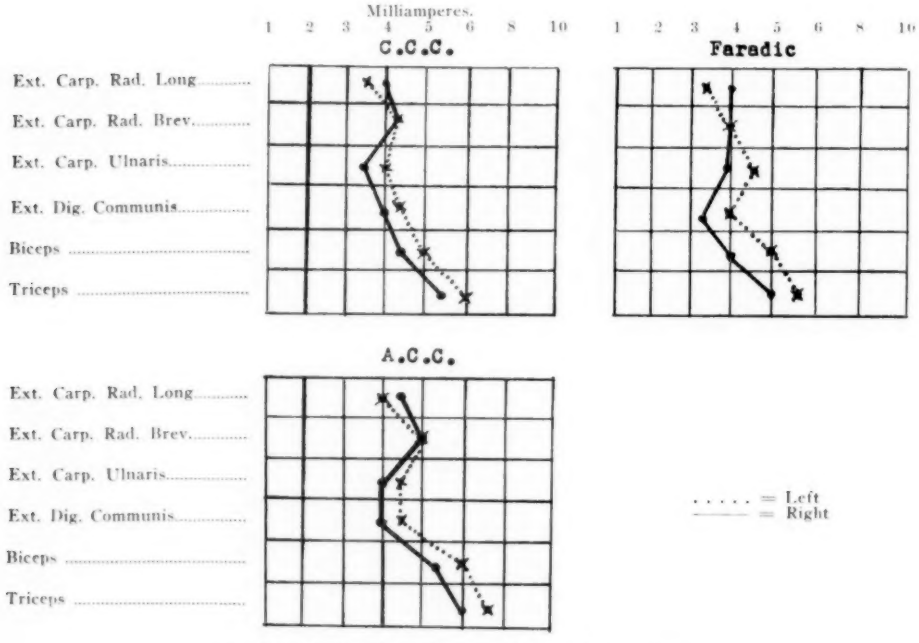

Fig. 5. — Hysterical paralysis with bilateral wrist drop.

There was atrophy of the shoulder group of muscles, the biceps, brachialis anticus and supinator longus. The biceps reflex was lost, flexion of the elbow impossible, and the arm could not be abducted or rotated outward.

In addition to the quantitative changes there are certain qualitative changes present in various pathologic conditions. Qualitative changes in the form of slow and sluggish muscle responses are characteristic of various myastheniform reactions. Distinct qualitative changes alone are very uncommon. However, in association with quantitative changes they are quite common.

When a nerve fiber is cut off either partly or entirely from its cells of origin, certain nutritive changes become evident. With these there is a change in both the excitability of the nerve and the character of its response. The irritability of the muscle is diminished to very much the same degree as the nerve trunk. With varying pathologic degrees and stages it is only natural to expect changes in the diminution of both the faradic and galvanic currents. When these qualitative-quantitative changes are present one speaks of a reaction of degeneration.

Various stages of the reaction of degeneration exist and can be shown by graphic representation throughout the course of a disease. A muscle with its nerve supply injured may first respond to a galvanic current of 5 ma.; after a few days it may require 10 or 20 ma. and finally loses all power

of contractibility. The reaction of degeneration may be complete or partial. If complete, the nerve does not respond to either galvanic or faradic current. There are some stages of so-called complete RD in which the muscle responds to the galvanic current. When and if this occurs the strength of the current is great and the reaction obtained is very sluggish. In the partial reaction of degeneration, galvanic and faradic responses are decreased, and there may be inversion of the polar formula.

Complete RD is found in destructive lesions in which the cells of origin of the nerve fibers have been interrupted. These conditions may occur in any of the motor nuclei of the cranial nerves, or in the anterior horn cells of the spinal cord. Diseases of the meninges or spinal roots or any affection of the peripheral nerves may produce a complete RD. The most common of these diseases are anterior poliomylitis, traumatic and infectious neuritis, and new growths.

The accompanying table of Kovács (table 3), shows the faradic and galvanic responses to the various gradations of RD.

TABLE 3.—*Stages of (RD) Reaction of Degeneration*

		Faradic	Galvanic
Normal Reaction	Nerve / Muscle	Tetanic Contraction.	Single Brisk Contraction.
Partial R D	Nerve / Muscle	Diminished Response.	Diminished Response / Sluggish Contraction
Full R D	Nerve / Muscle	No Response.	No Response / Sluggish Response
Absolute R D	Nerve / Muscle	No Response.	No Response

Complete RD is shown in the following case of facial paralysis:

A white man, age 60, suddenly developed paralysis of the right side of the face three years ago. This was not associated with any pain and no etiologic factor could be obtained. Repeated neurologic examinations have revealed no other symptoms than those expected in a peripheral facial paralysis. He has been under observation for two years and has shown no change. Since the complete RD is of so long standing the prognosis is very unfavorable.

Electrodiagnosis of Neuroses

There is an entirely different group of conditions in which electrodiagnostic methods are of especial value — hysterial paralysis, malingering and the various types of compensation neuroses. With a careful history of the development of the alleged infirmity, and by a detailed neurologic examination we may conclude that the condition is functional and not organic. With the unskilled, however, this is only guess work and the physician may not be sure of the proper therapeutic procedure. Just a few seconds with faradic stimulation will prove beyond any doubt, if the muscles contract, that the condition is functional. In this industrial age, where employees are well compensated for slight injuries, it is very common for them to magnify their symptoms, since a number would rather loaf and receive two-thirds of their pay than to work full time. Physicians today should be trained in the simple methods of electrodiagnosis, since legal complications of many injuries are imminent. One especially skilled can demonstrate to the satisfaction of the court that the alleged injury is either real or simulated.

The following case of hysterical paralysis is illustrative:

A white woman, aged 36, was under observation for a period of one year. She had numerous complaints which did not seem to have an anatomic basis. One of her chief complaints was chronic constipation for which she had received treatment. On one oc-

casion she complained of an inability to control the movements of her right hand. This gradually become worse, resulting in wrist drop. After a lapse of a few days, she complained of a similar condition in the left hand. For a period of about one week the patient had bilateral wrist drop.

Upon examination it was found that she held the hands in complete flexion on the forearms. Voluntary attempts to extend the hands met with failure. The palms were warm and moist. Reflexes were poorly elicited. Electrical examination with both faradic and galvanic currents revealed no deviations from the normal. The contractions were brisk, well formed and not sluggish, although they appeared to be sustained for a greater length of time than normally anticipated. Immediately after the current was removed the patient's wrists were limp and gave the appearance of their previous attitude of wrist drop.

Inasmuch as the electrical response to both types of current was normal, a diagnosis of functional bilateral wrist drop was made. The treatment instituted was chiefly psychic to which the patient responded exceptionally well, with recovery after a few days (fig. 5).

Conclusion

In conclusion we wish to emphasize the importance of these electrodiagnostic methods as a necessary part of the neurologic examination. From the standpoint of practical application they are of clinical value in the diagnosis and prognosis of diseases affecting the peripheral nervous system. Since it requires about twelve days for a nerve to degenerate, the application of electrodiagnostic methods during this time has no prognostic significance. If after this period one obtains a faradic response, recovery will be rapid in a few weeks. Should there be a galvanic response only, then recovery may be expected in a few months.

Reference

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AMERICAN REGISTRY OF PHYSICAL THERAPY TECHNICIANS

IMPORTANT NOTICE

January 1, 1939 is the closing date for those eligible under waiver clause to register **without** examination.

January 1, 1940 is closing date for Junior registration.

For further information address Registrar, American Registry of Physical Therapy Technicians, 30 North Michigan Avenue, Chicago.

TREATMENT OF PAINFUL BURSAE OF THE SHOULDER *

A. A. MARTUCCI, M.D.

PHILADELPHIA

In order to combat a painful sensation manifested by a patient, it is necessary at first to obtain a clear insight into its origin. The more deeply we are able to penetrate into it the more successful will be our therapeutic measures.

Analysis of a pain about the shoulder may most suitably be started by obtaining its characteristics. In order to do this it should be made a rule always to have the patient point out exactly the spot or the area in which the pain is felt, and specify whether it is superficial or deep seated. Vague statements are of little value and are frequently associated with totally erroneous conceptions regarding the site or area involved.

Interpretation of Pain

Where the pain is a radiating one it is necessary to differentiate between the painful focus and its peripheral radiations. In such cases it will usually be found that from the diagnostic point of view the focus often coincides with the area in which the pain was localized at the beginning of the attack. Of no less significance than the location of the painful focus, which ordinarily is at least in proximity to the etiologic point, are the radiations of the pain especially in cases in which there is no ground for assuming a neuropathic tendency in the patient.

The extent of the area involved by the radiation of the pain in paroxysms, frequently appears to be directly proportional to the intensity of the neuropathic tendency.

Some neuropathic individuals try to mislead the examiner, a painful stimulus being exhibited in a magnified form. With such persons the hypersusceptibility of their respective centers may result in even the slightest disturbances, possibly vasomotor or nutritional instability being recorded as painful sensations; this is probably the explanation of the vague rheumatoid pains so frequently complained of by neurasthenics. Neuropathic individuals like to speak of their sensations in the superlative, even when these are actually slight. Due consideration must be given to the reflexes of expressions in endeavoring to estimate the severity of pain.

Experience shows that intense and persistent pain in the course of time nearly always leads to more or less serious disturbances in the condition of the body as a whole, so that disorders of nutrition and loss of weight result.

The quality of the pain is also significant, not infrequently light may be thrown on the pathogenesis or nature of these pains through the description which the patient gives of them as being boring or piercing. Pain resulting from muscular spasm is often experienced as a cramp.

In painful bursae of the shoulder exact analysis of the pain demands the accurate determination of all the factors which influence the intensity of the sensation. Such modifying factors are intimately connected with the causative condition and are therefore of the greatest importance from the diagnostic point of view.

* Read at the Eastern Sectional Meeting of the American Congress of Physical Therapy and the New York Physical Therapy Society, Newark, New Jersey, April 2, 1937.

It is very difficult to find any accurate description of the subacromial or subdeltoid bursa. According to Codman the subacromial bursa the subdeltoid bursa and the subcoracoid bursa are one and the same thing although films of tissue separate them, depending entirely on the anatomic position and also whether the arm is in abduction or rotation.

After trauma or operation in this region the film-like partition in various parts of the bursa may become adherent and cause it to split up into a number of small sacs. The synovial lining of the bicepital canal has sometimes been described as a bursa.

In all motions of the scapulo-humeral joint, the subacromial bursa is in constant use. Soreness in the bursa will produce a spasmodic locking of this joint, throwing out of action the supraspinatus and the deltoid which perform the abduction movement.

Codman states that inflammation in the small sac of the bursa may be replaced by a number of smaller sacs and that lesions in the supraspinatus tendon are the most common cause of bursitis, just as lesions in the appendix are the common cause of peritonitis.

Since the success of treatment depends in most conditions on our knowledge of the exact pathologic structures, we should picture in our minds, the relative proportions of the elements of the joint involved. If the patient does not respond to the prescribed treatment of bursitis, a small rupture of the supraspinatus tendon with small areas of necrosis may be the underlying factor. I concede it is difficult to make a differential diagnosis especially where there is no calcification. However I believe that this is a matter of touch, which can only be learned with experience and even then it is very deceptive.

A brief history may give a clue. In acute subacromial bursitis there is a localized tenderness and protective spasm, sudden onset, due to the following causes.

1. Acute trauma on top of the shoulder.
2. Prolonged hyperabduction.
3. Inflammation of surrounding tissues.
4. Rupture of muscle or tendon fibers about the bursa.

If one insert a needle into the base of the bursa, there will arise spasms of the shoulder muscles. This would indicate that the bursa is supplied by nerves which excite the scapulo-humeral reflex.

Treatment

The prognosis of these cases is ultimately good, but the probable course cannot be foretold with certainty, and no treatment of a dangerous nature can be considered. Recovery under proper treatment is only a question of time. The object of treatment is the relief of symptoms.

Some persons who do not fear operations will submit to it, the results being problematic. Physical therapy is the treatment of choice; it is free from danger and sure to relieve the acute symptoms in one or three applications. It does not require hospitalization.

In acute painful bursitis diathermy, conventional or short wave, is the agent par excellence. In using the former the electrodes are placed about the middle third of the humerus and the middle third of the clavicle; duration of treatment should be 45 minutes. With short wave diathermy the duration of treatment is reduced to about 20 minutes with the electrodes in the same position or at the same site.

No motion or massage should be permitted, but the patient should be compelled to carry the arm in a sling, night and day. The arm should not be used; the treatments should be given at least three times weekly, daily

treatments being preferable. After two weeks gentle massage should be instituted in connection with the high frequency treatment.

Some will say that the deposit and exudate will naturally become absorbed in time; the same criticism applies to the results of surgical removal. X-rays will show absorption or removal of deposits but pain may still be present. I have several patients who were treated with diathermy with complete relief of symptoms and yet the deposits are still present. Many orthopedic surgeons in Philadelphia believe that diathermy is the treatment of choice.

These painful bursae require individualized treatment. I mentioned that diathermy should be applied the first two weeks without massage; but we must consider the results obtained and the pain present. If the pain is acute I do not give massage no matter how many treatments the patient may have. However, if pain subsides after two or three treatments I institute massage with the diathermy; and later if relief from pain is secured I add to the diathermy and massage some assistive active passive motion given judiciously.

The results are uniformly excellent; I have treated cases in which one treatment was sufficient for a complete cure and without return of symptoms. Other cases I have treated over a period of four months.

There is one form of treatment which I believe should not be used, complete fixation of the shoulder either by strapping or by plaster cast. I have seen the periarticular structures become fixed; the muscles atrophy and become ischemic and contracted. Many months pass before the joint moves again, the neurotic pains are annoying and even if pain is absent the patients are hampered by the ankylosed joint.

Most patients respond to palliative treatment, consisting of diathermy, massage, assistive active and passive motion judiciously given; some require a prolonged convalescence and suffer a great deal, but generally there is no loss from work and the patient will improve in time under continuous treatment.

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Discussion

Dr. K. G. Hansson (New York): The title of Dr. Martucci's paper is "Treatment of Painful Bursae of Shoulder." A differential diagnosis is therefore indicated. We should exclude arthritis of the shoulder joint, brachial neuritis, deltoid myositis, and acromic-clavicular separation. It is often difficult to differentiate between a tear of the supraspinatus tendon, and a subdeltoid bursitis. The insertion of the tendon is covered by the bursa. According to Codman all types of bursitis are associated with a tear of the supraspinatus. However, this does not seem rational. There is undoubtedly a clear cut bursitis. This often occurs without a history of trauma. Exposure seems as common an etiology as trauma. I don't believe that foci of infection play any part. It is more common in men than women, and nearly entirely confined to the ages between 20 and 50.

Examination reveals acute pain and tenderness over the subdeltoid, subacromial, or subcoracoid regions. Abduction, external and internal rotation are limited by pain. Patients often refer pain to the insertion of the deltoid muscle. X-rays often show large deposits of calcium, which seem of no great importance. The acute stage usually lasts four or five days. During this time treatment consists of immobilization in a sling, with weight on the forearm to relieve pressure on the bursa, an ice bag to the shoulder and some sedative or opiate.

After five days the pain subsides, and now we apply diathermy. I prefer a diathermy application of a small electrode over the bursa and a large electrode in the axilla or on the medial arm.

Acute bursitis is self-limited, but there is a decided danger of a "frozen" shoulder as a sequela. Loss of motion in the scapulo-humeral joint is compensated by shoulder girdle movement, and we are all

familiar with the difficulty that a "frozen" shoulder presents.

I therefore believe that it is important to start a patient on certain exercises at the end of the first week. The exercises that I prescribe are relaxed movements taken three times daily. This treatment will prevent a shoulder from becoming "frozen."

If a stiff shoulder is to be mobilized I have obtained the best results with static wave and spark massage, with strong passive exercises in addition to the relaxed movements.

I agree with Dr. Martucci that operative procedure is seldom indicated. Injections with novocain or sodium cacodylate, or the irrigation of the bursa with saline has worked well in the hands of those who have mastered the proper technic. I may say that when a physician suffers from an acute bursitis, it has been my experience that he prefers physical therapy.

Dr. N. E. Titus, (New York): In the acute stage of bursitis I feel that immobilization and photothermy are the only measures that should be used. Diathermy, if given so that it affects the bursa, generally will increase the pain. Having had this condition myself, I can speak feelingly.

When the acute stage has passed and the patient is able to move around for treatment, I have found that photothermy and the static brush discharge give the best relief. If after a few such treatments the pain is not entirely alleviated, diathermy may be given, but I do not believe that any of the technics described directly or efficiently affect the bursa. Why not give diathermy to the bursa instead of heating the whole shoulder region and hoping that the bursa is being helped?

Even though short wave treatments are advocated for the simplicity of their application, grounded autocondensation is an even simpler technic. This I described in 1923 when I reported a small series of cases before the American Academy of Physical Therapy.

To give grounded autocondensation the patient is seated on an autocondensation pad which is connected to one terminal of a large diathermy apparatus, and holds a handle which is connected to the other terminal. Between 800 and 1,000 milliamperes of current is used and the operator places a finger over the bursa, for ten minutes. Thus all the high frequency current is grounded through the operator's finger and when it becomes too hot for that finger, another is placed on the skin. As the dosage is limited by what the operator can tolerate, there is no danger of burning the patient. No other technic will permit such high dosage nor force the current through the bursa, which is of high ohmic resistance when indurated and chronically inflamed.

Putting a small metal electrode over the bursa limits the current to an ineffectual amount. If a large metal electrode is used so that it curves to cup the shoulder, no current will go *through* the bursa, as it will all be lost going from the edge of one electrode to the edge of the other. Diathermy treatments require a real understanding of how the current flows through tissues in order to produce good results.

It is too often believed that diathermy and a prayer are enough, but this is not proper physical therapy. Cases so treated take much longer to clear up than those which have something done to promote absorption of the exudate, be it calcareous or not. For this reaction nothing can compare with static electricity, especially the brush discharge.

When a patient has passed the acute stage, there is generally a remaining spasm of the infraspinatus, teres major and teres minor muscles. This can be mildly helped by massage and exercise, but here again the static current, given as a wave, is incomparable. Sinusoidal would even be better than massage for the myositis.

In closing let me state that in my experience with well over a thousand cases, I have never seen any in which infection could be blamed as the causative factor. To my knowledge no one has ever reported a primarily infected subdeltoid bursa, proved by operation. Focal infection will delay recovery from the chronic myositis accompanying the condition, but it does not play a role in the picture of the local condition.

Dr. Richard Kovács (New York): I agree with Dr. Martucci that penetrating heat by diathermy is the main standby in the treatment of the average case of bursitis especially of traumatic origin. I recall one outstanding experience in my early practice. The wife of a physician had had an attack of sub-deltoid bursitis in one shoulder which was operated on. Two years later she had an attack of the same severity on the opposite arm and I was called to treat her. I found her in bed with the shoulder in forced abduction and she was suffering considerably. I used what was fifteen years ago the new method of diathermy, and in a few days most of her pain was gone and with continued treatment she regained full comfort and function in that arm. In contrast to this perfect recovery the arm which was operated on showed a deep adherent scar, limitation of abduction and at times it was still painful. Unfortunately some surgeons still consider operation as the first line of attack in calcified bursitis. I had occasion just two days ago to dissuade a patient from being operated on for a typical sub-deltoid bursitis which had received no physical treatment at all. I have no doubt that this patient will recover without operation.

The stage and severity of bursitis naturally makes a difference in the management as well as in the form of heating. In very severe cases every manipulation, including the placing of electrodes is contraindicated. Mild radiant heating from luminous or infrared sources is usually well tolerated and can be given intermit-

tently for an hour or two at the time in the patient's home and if necessary with the patient in bed. The use of sedatives may be indicated for the first 48 hours in very severe attacks. As soon as the acute symptoms subside diathermy by the longitudinal method,—one semicuff electrode well above the shoulder the other over the middle of the arm, should be started. A few days later the cautious application of plates in transverse lateral position can be attempted and voluntary exercise of the shoulder initiated. Massage is badly tolerated even in the subacute stage, but may be used later.

Short wave diathermy gives results similar to diathermy; it offers the advantage that treatment drums on the arms can be applied in the early stage without touching the parts. The static brush discharge is a useful adjunct to relieve local tenderness over the bursa, while monopolar high frequency sparking (the Oudin current) serves to relieve neuritic pain along the entire arm.

Dr. John D. Currence (New York): Dr. Martucci brought out the method that is practical to alleviate painful bursae in most cases. He stresses the importance of a careful physical examination preliminary to treatment. I believe this point bears elaboration. Mention can be made of laboratory details in the diagnosis. I believe possibly some other methods of treatment might be advantageous in some cases. For example, in a case of acute traumatic bursitis, where a hemorrhage might be present, it would be better to depend upon complete immobilization for a limited period before beginning short wave or diathermy treatment. If an individual is suffering from an infection, which is apparently systemic, and has a marked rise in the sedimentation rate with deviation of the filament and non-filament count, or is suffering from a systemic infection which is localized as a signal manifestation in the arm, very often medicinal treatment will be of equal value. If in cases with a definite active systemic infection this is first eradicated, relief can often be obtained without any local treatment to the shoulder proper. If relief is not obtained, then in most cases I agree that Dr. Martucci's method of treatment is usually the choice for ambulant cases. After the acute pain is relieved and a period for starting passive and active motion arises, under water exercises are advisable. The patient is immersed in a tank sufficient to relax the spasm of the muscles and under water they are given passive motion. In this way a marked degree of function can be obtained almost at the first treatment.

By the use of hot hydro-massage greater relaxation will occur and the period of disability will be materially shorter than if hydrotherapy had not been used following the short wave or diathermy treatment. As soon as the patient is capable of definite active motion, sufficient heat in a tank to relax the spasm affords a greater amount of motion. If the bursitis has persisted long enough to cause atrophy, under water the patient will be able to move with much greater ease due to the fact that much less power is required to achieve a good amount of motion, and with relaxation and relief the muscles function much more rapidly and the period of disability is materially decreased.

FEVER THERAPY IN OCULAR DISEASES *

J. M. BERRIS, M.D.

and

M. K. NEWMAN, M.D.

DETROIT, MICHIGAN

During the decade of 1920-1930 fever became recognized as essentially a protective and defensive physiologic process. As a result numerous attempts were made to imitate natural febrile processes by injection of foreign proteins, bacterial products and various chemical agents. The present decade is witnessing the logical outgrowth of this earlier work. It is now our aim to produce fever alone, without the biochemical after changes produced by the introduction of foreign materials. These changes are always modified by individual reactivity, and though predetermined are largely unpredictable and uncontrollable.

In a measure this therapeutic aim is being realized by physical agents for the production of hyperpyrexia. The most popular instrumentalities at present

* Read at the Sixteenth Annual Session of the American Congress of Physical Therapy, Cincinnati, Ohio, September 21, 1937.

seem to be heated humidified cabinets, radiant heat cabinets, and short wave current induction apparatus. Our own preference has been previously described and the technical administration forms no part of this report.[1] It will suffice to reiterate the statement often previously made; namely, that sustained artificial fever should be administered only by an experienced technical team of physicians and nurses, and that the initial session should be in the nature of a test of the tolerance of the individual patient.

The physiologic effects of artificial fever have been carefully studied by many workers. Those effects which interest us chiefly are leukocytosis, increased phagocytosis, increased blood flow, decreased circulation time, stimulation of antibody formation and the lethal effects on the gonococcus and related organisms.

Favorable clinical reports on fever therapy in gonorrhea and its complications, syphilis, chorea, undulant fever and arthritis are abundant.

Disease processes which attack the orbit and its contents can all too quickly lead to major catastrophies. It is a tragic fact that what would constitute an insignificant inflammatory process elsewhere in the body, localized in the eye becomes an immediate menace to its integrity. Ophthalmologists as a class because of this fact, are therapeutically open-minded and are willing to attempt rational therapeutic innovations.

Clinical Reports

During the past six years at the Grace Hospital, we have been afforded clinical material by ophthalmologists and it is our purpose here to present briefly case reports illustrating the effects of fever therapy in ocular diseases. The following three cases represent ocular syphilis:

Case 1. — A man, aged thirty-six, a butcher by trade had an initial infection in 1919 and was treated by local therapy only. He was married in 1922, and later examination showed the wife and all three children of the marriage to be syphilitic. There was no history of secondary lesions. In January, 1934 he began to complain of headaches and dimness of vision and exhibited mental deterioration. When hospitalized in September, 1934, he was completely blind and disoriented. The neurologic report suggested an unlocalizable intracranial gumma, bilateral choked discs, high grade, paretic gold curve and strongly positive spinal fluid. He received daily fever sessions of one hour at 103 F. for a period of fourteen days with no concomitant chemotherapy. He left the hospital with 20/60 vision in both eyes, and an apparent complete recovery of mentality. No further studies were made, but when last heard from this year he was working at his trade.

Case 2. — This patient had congenital syphilis with the Hutchinsonian triad of nerve deafness, notched teeth and bilateral interstitial keratitis. Age 18. Patient had been a house painter, but for six months prior to instituting treatment had been unable to work because of poor vision. Blood Kahn was negative but spinal fluid was strongly positive. The patient received ten treatments of 3 hours duration at 103 F. at three day intervals. For two years preceding treatment he had been unable to read, and upon discharge vision had improved to the extent that he was able to read large newsprint. No subsequent accurate ophthalmologic studies are available. Chemotherapy was instituted and there has been no reactivation of the ocular process in three years. When last seen there had been a definite objective clearing of both corneae.

Case 3. — Male, aged 32, had initial infection at age of 24. He had been treated by intermittent chemotherapy and at no time had any secondary manifestations. He began to complain of dimness of vision at the age of 30, and became progressively worse until seen by the ophthalmologist. Report at that time revealed irregular fixed pupils and a progressive optic atrophy with strongly positive spinal fluid and blood. There were no other signs of central nervous system involvement. This patient received fifteen fever sessions with a complete arrest of the process, and in the past three years had had no recurrence of symptoms.

The concensus of opinion at the present time would indicate that in active exudative lesions of the ocular apparatus fever therapy is quite efficacious.

Culler[2] and Culler and Simpson[3] noted that exudative uveitis, active choroiditis, optic neuritis and neuroretinitis responded excellently. In most instances the progress of the disease was stopped entirely. In the treatment of well-advanced optic atrophy response is usually unfavorable, but if a focus of infiltration occurs along the optic tract a favorable result will be obtained in proportion to the amount of nerve involvement. Bierman[4] reports similar findings. In one case of interstitial keratitis treated by us, in which a central opaque disc of plastic exudate was present, clearing was very rapid.

The following case of gonorrheal ophthalmia reveals the efficacy of fever therapy in gonorrheal infections:

Case 4. — This patient, age 28, was a school-teacher, who innocently developed an infection of the right eye. One week before being seen by the ophthalmologist she had been treated for a non-specific conjunctivitis. Smears made from the purulent discharge revealed many neisserian gram-negative intracellular diplococci. She received local antiseptic treatment for one week without any definite improvement. At this time the discharge was still positive and complete orbital destruction seemed imminent. Fever therapy was instituted, the treatment consisting of six hours of elevated temperature at 106-107 F. At the termination of treatment no organisms could be found in the smears. As a measure of safety a second treatment was given one week later. When last examined, perception for light, color and large objects had returned, and the corneal ulcer had almost completely healed.

(Two other patients have been treated by fever therapy with rapid resolution in one to two treatments.)

By far the most terrifying of the acutely malignant eye infections is severe gonorrheal ophthalmia. Recourse to treatment in the past has been all too unsuccessful, and usually results in at least complete loss of vision or evisceration of the involved eye. When studies by Carpenter et al,[5] and others, showed the thermolability of the gonococcus at temperatures above 105.8 F., at last was obtained a weapon to eradicate this type of ocular infections. Altogether too few cases have appeared in the literature, indicating not sufficient use of this therapeutic procedure. Metz[6] demonstrated cases of gonorrheal ophthalmia that showed rapid recession of pain and inflammation with subsequent clearing of the entire process. Ormond[7] noted a complete clearing of one case of gonorrheal ophthalmitis with a single fever session. Hasler and Spektor[8] using a radiant energy cabinet noted a cure of a case of gonorrheal ophthalmia in one fever session. Hamilton[9] and later others injected boiled cows milk intramuscularly in the gluteal region in increasing daily doses, rarely achieving a body temperature of more than 102 F. Where the eye infection was not already hopeless a good result was achieved. Pinkerton reported three cases with boiled milk injections and some type of a heat cabinet, producing cures in one to three sessions. In one of our own cases a fifty year old woman developed an acute specific salpingitis, polyarticular arthritis and a beginning conjunctivitis. Following one fever session the ocular symptoms cleared entirely, indicating a probable neisserian infection as the causative agent.

We present three cases of non-specific iritis:

Case 5. — Patient, aged 24, bookkeeper, following an acute upper respiratory infection developed a painful right eye with photophobia and profuse lacrimation. The ophthalmologist reported that two weeks of therapy with local measures and foreign protein injections gave no relief. His diagnosis was acute iritis. Following a four hour fever session at 106 F. there was complete subsidence of the inflammatory process of the iris. Within one week all objective manifestations of the inflammation had disappeared.

Case 6. — Italian laborer, age 28, developed an iritis of six weeks duration during which the complaint was photophobia, lacrimation, ocular pain, polyarticular pain and fever. He received three fever sessions at 103 F. at three day intervals, with complete clearing of all objective symptoms and objective manifestations.

Case 7. — Railroad clerk, age 30, had a recurrent iritis for the past five years, attacks occurring only in the fall. Allergic studies were negative and no foci of infection were found. Shock therapy which had been effective in controlling the previous attacks failed and fever therapy was instituted. Complete subsidence of pain, inflammation and photophobia occurred after two treatments.

Fever therapy has had considerable application for some time in non-specific inflammatory ocular processes. Conditions have been corneal ulcer, acute and subacute iritis and conjunctivitis. Boiled milk, typhoid-paratyphoid vaccine and diphtheria antitoxin have proved efficacious in the hands of such workers as Miller,[10] Scarlett and others. Bennett and Austen[11] noted excellent results in subacute iritis treated with the Kettering Hypertherm. Whitney and Doub[12] and Whitney[13] noted marked clearing of signs and symptoms in nine cases of corneal ulcer and six cases of acute iritis. However, in six cases of penetrating wounds of the eye, only a single brilliant result was obtained. Metz[6] reported marked clearing in a case of phlyctenular keratoconjunctivitis with a single fever session, with three additional sessions resulting in a cure. Faget[14] obtained remarkable results in seven cases of non-specific ocular involvement (traumatic iritis, corneal ulcer and acute conjunctivitis). The principal complaints in each instance were pain and inflammation, and a single fever session produced a great deal of relief, one to three sessions being required for a cure. Coulter[15] finds hyperpyrexia to be of value in iridocyclitis, corneal ulcer and choroiditis. In our series a carefully treated case of diabetic keratitis responded after two fever sessions with clearing of pain and inflammation. Our experience with non-specific ocular conditions has been that pain and inflammation subside very rapidly after a single fever session.

Comment

1. The results of fever therapy in ocular gonorrhea are nearly always astonishingly prompt. Administered early, severe physiologic damage can be prevented. In iritis, when gonorrhea is suspected but cannot be proved, fever therapy is worth a trial.

2. So-called rheumatic iritis is frequently benefited by fever therapy after routine treatment and protein shock therapy have proved ineffectual.

3. A case of diabetic keratitis was favorably influenced by fever.

4. In the therapeutic regime of ocular syphilis, fever therapy has a definite place. Our experience has been that specific optic atrophy can be arrested in a progressive case, but the damage already present is irremediable. Interstitial keratitis usually responds to fever therapy when opaque central plastic exudates are present. Secondary amblyopia, following increased intracranial pressure in brain gumma, responds particularly well to fever therapy.

Conclusion

There should be no hesitancy on the part of the ophthalmologists in making use of well-established fever therapy departments for cases of ocular gonorrhea, ocular syphilis and the stubborn iritides. More clinical experience of course is necessary in order to properly evaluate the place of fever in ophthalmic therapy. Preliminary remarkable results warrant its further exhaustive trial.

10 Peterboro Street.

(*Concluded on page 636*)

STERILITY OF MALE ANIMALS INDUCED BY RADIANT HEAT *

UPTON GILES, A.B., M.D., A. L. HARVEY, B.P.E., A.B.,
and
F. W. DAMPERE, R.N.

NEW ORLEANS

The past few years saw an accumulation of considerable data and widespread interest in fever therapy by physical and other methods in the management of varied conditions. It is noteworthy that induction of fever has been carried out in more than one hundred different organic diseases ranging from adenitis, adiposis dolorosa and varicose veins, to the more severe group, such as bacterial endocarditis and undulant fever.

Induction of fever is obtained by chemical, foreign protein, infectious and physical methods. Since physical methods have proved in most instances far superior to the others, we are using these in our experimental work. Through radiant heat as our means of fever induction, we are attempting to ascertain the condition under which sterility can be induced in a selected group of potent male animals and to learn how closely these conditions approximate similar experiments with man.

It is not amiss at this time briefly to review the anatomy of the scrotum and testes. The scrotum is a cutaneous pouch for the protection and support of the testes and part of the spermatic cord. The external appearance of the scrotum varies with different conditions. This is an important consideration. For example, under the influence of cold and in the young and robust, the scrotum appears to be short, corrugated and close to the testes, while under the influence of warmth and in the aged or debilitated, it becomes elongated and flaccid.

The testis is a glandular structure, ovoid in shape, and consists of lobules of seminiferous tubules, supporting tissue, ducts, vascular supply and neurogenic connections. This organ is covered with three layers known as tunics; the tunica vaginalis, the tunica albuginea and the tunica vasculosa. The microscopic anatomy of the testicle presents three distinct structures of physiologic importance. The interstitial cells of Leydig lie within the loose connective tissue between the tubules and are considered by many the source of internal secretion. The sustentacular or supporting cells of Sertoli are located within the basement of the seminiferous tubules. Their function has been disputed, many individuals claiming that they produce the internal secretion. The epithelium of the seminiferous tubules is the direct source of spermatogenesis.

Scheme of Spermatogenesis

We shall briefly review the process of spermatogenesis. The epithelial lining of the seminiferous tubules consists of two types of cells, the supporting or sustentacular cells and the glandular or spermatogenic cells.

First, we see spermatogones, or mother cells. These are cuboidal in shape and lie against the basement membrane. They multiply by a process of mitosis and form the second layer of seminal cells, the spermatocytes. These are large, spherical cells and form from two to four layers adjacent to the inner sides of

* From Department of Physical Therapy, Charity Hospital.
Read at the Sixteenth Annual Session of the American Congress of Physical Therapy, Cincinnati, Ohio, September 22, 1937.

the spermatogones. Again by mitotic subdivision, the spermatocytes are transformed into spermatids. It is the opinion of Ferguson and others that through a process of union of the spermatids with the Sertoli cells the spermatoblasts are formed. These are the progenitors of the spermatozoa.

Through laboratory experiments, Moore and others disclose that the scrotum regulates the temperature of the testes, and that spermatogenic activity is dependent upon this function. Testes, when permanently placed intra-abdominally, become highly disorganized and the germinal epithelial layer essential to spermatogenesis, becomes absorbed. They demonstrated that when testicles are placed in a subcutaneous location or pouch, the germinal epithelium continues active, but spermatozoa are never produced. This experiment produces more trauma in the testicles than if they had been placed in the abdominal cavity. It has been proved that the intra-abdominal temperature is several degrees higher than the subcutaneous tissues. It is this difference alone which can activate or inhibit the function of the germinal epithelium of the seminiferous tubules. Conclusive evidence has confirmed the results of the experimental procedures, that cooler environment than the interior of the abdomen is necessary (in most animals) for proper testicular function and the scrotum provides such necessary environment for the completion of spermatogenesis.

The testes possess the dual function of forming sperm and internal hormone secretion. However, in our experimental work only the sperm formation could be ascertained with a degree of accuracy and detail. Because of the difficulty in determining the sexual characteristics in animals, we have found that we could partially eliminate this study. An accurate index can be made in the determination of spermatogenesis by the knowledge of the ability of the animal to procreate. This index does not reveal numerically the sperm formed. Furthermore, the potency of the male animal to procreate can be determined by his mating with successive groups. However, this becomes only relative; but, in a way, it gives a fairly good index to spermatogenesis and also to the state of preservation of the seminal gland. This determination has been carried out with the animal prior to experimentation.

While potency becomes the determinant of the index to procreate, sterility on the other hand is an index to the changes which occur in the testicular secretion in the production of inactive spermatozoa or lack of them. Often the term sterility has been used ambiguously to include the sexual instinct and libido, but as long as the animal can carry on the sexual act and has no ability to procreate, it must be regarded as sterile. Sterility may be classed as physiologic and pathologic. However, in the segregation of animals for this experiment there have been found a few male animals which though young were unable to procreate, yet as there has been no determining cause for this disability a biologic disorder underlying their lack of potency may have been present. Therefore they belong to the physiologic group. Other animals might be potent for different reasons or show sterility between fever sessions. With these we may conclude that there is some pathologic cause for their condition. This distinction has to be made carefully in the study of our experiment.

In the study of sterility in animals there have been numerous experiments performed to prove that there are certain lesions within the body responsible for lack of potency. In fowl, it has been shown that the experimental lesions of the cortical centers of cerebral hemispheres produce sterility although there is no interference with libido. There have been no records disproving the fact that lesions in animals produce the same results. Presumably, there must be a cortical control for spermatogenesis. It is known that ligation of the spermatic duct produces sterility and pathologic changes similar to those found in cryptorchids. Histologic studies of cryptorchids show that the seminal gland alone

is lacking, the other elements of the gland being normal. As with fowl, these animals have libido, though the ability to procreate is lacking.

Ancel and Bouin removed one testicle from animals and a section of the vas deferens of the opposite side. After many months examination of the remaining testicle showed complete disappearance of the seminal gland and advanced degeneration in the Sertoli cells. There was a compensatory hypertrophy of the interstitial cells. Though these animals were sterile there was no diminution in sexual libido or power. This experiment parallels that of cryptorchids in that there is a predominance of the interstitial gland with lack or absence of the spermatogenic cells. This alone is an evidence of sterility.

Experimentation

The animals used for this investigation were white, grey and Louisiana swamp rabbits. This group comprised 56 mature males. The potency of the animals was determined by placing each test rabbit with a female rabbit, and thus the relative index of spermatogenesis was made. When the young mature females became pregnant, the male animals were segregated and used for the experiments. However, in the attempt to apply radiant heat or induced fever to the individual animals, we found that the Chinchilla and the swamp rabbits are more resistant to heat than the white rabbits. All animals were quite potent, but white rabbits were unsuited to our purpose, as they are thermically sensitive.

Of the selected group of 56 animals placed in the radiant heat cabinet, only 12 were able to receive eight sessions of fever; one received five; 4 received three; 12 received two; 4, nine; and 18 received one course or session.

The time exposure to radiant heat was approximately four to five consecutive hours. The normal preheating temperature ranged from 100.6 to 104 F. The average preheating temperature was 103.4 F. The degree of temperature obtained in the process of heating ranged from the minimum of 103.4 to the maximum of 109.6 F. Fever was induced regularly at intervals of from five to seven days for each session. Occasionally the temperature of the animal was elevated to 111 F., but death from convulsions always resulted after its removal from the cabinet.

The animals which received four successive sessions were again mated with the young mature female rabbits for a period of six weeks. (These were the same animals who bore young previously.) After this period of mating, they were again subjected to four additional fever sessions. Following this, they were again mated with the old and the new group of young female rabbits. Our study of the potency of these rabbits covered a period of a year.

Without taking into consideration the number of sessions received we observed that most of the animals which did not survive the experiment suffered convulsions immediately upon their removal from the cabinet. Rigor mortis set in promptly. The pathologic changes noted in this group were marked hemorrhagic tendencies throughout the lungs, the gastro-intestinal tract, the peritoneal and pleural cavities and definite hemorrhagic foci in the subpial, subarachnoid membranes and intracortical substance. Additional hemorrhagic lesions were seen in the adrenal gland and in the pancreas. Cloudy swelling of the kidneys and liver was sometimes evident.

Those animals which died twelve to fifteen hours after the fever sessions were subjected to a post-mortem examination. These were found to have had congestion of the lung with broncho-pneumonia and alveolar hemorrhages.

In those animals which died following the first fever session, there was no evidence of interference with spermatogenic activity as determined by histologic section.

Of the animals which perished following several sessions of fever, some showed minor degenerative lesions in the male germinal epithelium. Others showed definite retardation of spermatogenic activity, accompanied by exfoliation of the germinal epithelium.

Two animals which succumbed fifteen and eighteen months, respectively, after receiving the complete eight sessions of fever therapy, showed a complete disappearance of the germinal epithelium and degeneration of the Sertoli cells and proliferation of the interstitial gland.

Twelve animals that survived had been mated with different young mature female rabbits for approximately a year. They showed no diminution of sexual character or power, but evidenced no ability in procreation, as pregnancy never took place.

Comment

A survey of the literature on the various methods of inducing artificial fever in animals has been made and their relation to the production of sterility noted. We cannot consider the results comparable with those in which man was the subject for experimentation, as the normal temperature in man is usually less than that in lower animals. Then, too, respiration in the lower animals bears a more direct relation to the body temperature than it does in man.

It seems that while sterility in animals has been produced hyperthermically, this condition has been only incidental to the fever session. Our object has been to determine if sterility could be produced in potent male animals through radiant heat methods and that these methods approximate as nearly as possible to those used in man.

Summary

A study was made of the effect of radiant or exogenous heat on animal tissue of Chinchilla and Louisiana swamp rabbits. These rabbits proved more resistant to heat, and therefore best suited to our experiments. Fifty-six rabbits were used but only twelve survived.

The average preheating temperature was 103.4 F. The maximum degree of safety ranged between 108 and 109 F. and was maintained from four to five consecutive hours.

The morphologic changes occurring in the tissues of the non-surviving animals showed marked focal hemorrhages in the viscera and the central nervous system. Hyperemia and cloudy swelling of the organs were observed. A prolonged period of heating caused degenerating lesions in the male generative epithelium.

After the lapse of a year the surviving animals still possessed libido and sexual power, but do not have the power to procreate.

The results of our experiment may prove of value to the extent that prolonged sessions of radiant heat may produce alteration in the testicular secretions in man.

Discussion

Dr. C. A. Mills (Cincinnati): I am afraid that those who have been employing fever therapy in practice have now begun to envision themselves as responsible for reduction of the birth rate. I don't think we need worry quite as much as the essay would at first glimpse suggest, for while some of us may be hairy apes, we can still sweat under the hair, and rabbits cannot. They only weep through the skin when near death, or in prostration, and though the experiments on these rabbits were conducted in the same temperature range for human patients in the fever cabinets, we have an entirely different matter.

It is noticed, for instance, that the survival rate is 12 out of 56 — a little smaller survival rate than I hope any of us have had with the fever cabinets. It is obvious at first glance that the load put upon the heat dissipating mechanism of these rabbits is far and away beyond that which one puts upon the human subjects be-

cause of man's ability to perspire and get rid of body heat. Let us not get too worried all of a sudden.

On the other hand, the experiments which Dr. Giles presented do interest me very greatly. It so happens that I have mimicked his final results without any fever therapy but by making heat loss somewhat difficult, with a temperature of 90 to 92, with 70 per cent humidity. That does not kill the animals; they just become placid and take life easier. But after a couple of weeks at that temperature level, spermatogenesis has practically ceased altogether. There is no fertility, but the animals mate perfectly well. If you put the animals in a temperature of 60 or 70, they are fully fertile again, and you can skip that back and forth as much as you want. I might also say that the evidence in regard to temperature in the testicle itself being the effective factor is not as good as it should be. One can test that by putting them in a cool den and heating their testicles intra-abdominally, and they go up and down. So I am not at all convinced that intra-abdominal temperature makes a difference at all.

I have, however, done some work in making sterile animals fertile by the removal of radiant heat. We did that this winter in our laboratory, taking the animals that had been subjected to the hot moisture and rendered them thus completely sterile, and then keeping them in the same place, removing the heat by radiant means to a cold place, and in the cold they become fully active and fully fertile, as fully fertile as if you put them in 65 degrees.

While there is no doubt of this sharp and quick response of the germinal adjustments of the testicle to the heat load upon the body — that is, the ease or difficulty of dissipating body heat — we have to be pretty careful, I feel, in jumping over with these deductions to the human field, because of the marked difference in the ease of dissipation of an excess load of heat.

Dr. William Bierman (New York): The problem which Dr. Giles has brought to our attention is one of great practical importance in the administration of fever therapy. It has been known for many years that an elevation of temperature of the testicle will do damage to the spermatogenic function of that organ. That is the reason why the early workers in fever therapy hastened to reassure themselves that the element of danger in the use of this measure when applied to man would be sufficiently little to warrant its practical application.

Obviously if treatment of a case of gonorrhea, for example, in a male, by means of artificial fever would be responsible for the creation of a state of sterility, one would hesitate to recommend this method.

Men like Jacobson and Hosoi, according to my recollection, in histologic studies on the testicles of experimental animals, and Carpenter exposed rabbits to the high frequency field in the form of treatment that they subsequently used in the human, and both these groups of workers — Jacobson, Hosoi and Carpenter — reported that there was either no damage, or very little, to the spermatogenic function, that the litters of rabbits treated were no smaller and were no less frequent. There was no evidence of any reduction in fecundity as contrasted with their controls.

It was because of this early scientific experimental assurance that the rest of us had the courage to go ahead and treat patients with high temperature elevation. I reassured myself on this score first, because I did not want to blindly apply fever therapy without some definite recognition of a possible damage to the human testicle.

We have not done what somebody should do, namely, a statistical study of the results so far as reproduction is concerned, in our patients, and I dare say nobody has done it because of the very obvious difficulties that one would face in the effort to make such a statistical study, with the variations of the marital status, with the varying desires to have families and not to have families.

If we could guarantee that there might be either a permanent or temporary interruption of the spermatogenic function, we might have people applying for this treatment for just that purpose. On the other hand, there are a fairly large number of case histories among our human subjects who have been exposed to relatively high temperatures or to relative long periods of time in the treatment of gonorrhea, who have subsequently become fathers of families, or the father of a family. They may have been fathers of families before.

While it is true that in any critical study we would have to become detectives to make certain that these men really were the fathers of their families, yet it is reasonable for us to assume that that is the actual relationship, and so we do know of children born to men who have been exposed to the high temperature technic which we employ in the treatment of gonorrhea.

The work reported by Giles this afternoon would tend to show that the dangers which were called to our attention by Moore, at the University of Chicago, and by other workers, as to the possible deleterious influence of temperature elevation on spermatogenesis, may be founded in more fact than we who have been influenced by these experiments, such as those which I have previously mentioned, believe.

We have done some work experimentally with guinea pigs, and I would like to ask Dr. Giles something more about the technic. It was obvious from his statement as to the relative mortality of these guinea pigs that he probably had his difficulties in raising temperatures to any high level and maintaining them there for a period of several hours.

These animals have not as efficient a method for heat loss as the human being. They are covered with fur, and it is much

more difficult to produce thermic insults which lead to death in them than it is in man.

Another interesting observation would have been, I think, the actual determination of temperatures in the testicles. If we actually know what the thermal temperature was, it would be of additional interest, because it may be that the temperature differential between the temperature of the body as indicated by rectal thermometry may be fairly wide when contrasting such temperature determinations made in the testicle itself.

We have observed in studying the penile urethra that consistently its temperature is several degrees lower, and sometimes we found it even lower than the thermic temperature as indicated by the rectal temperature. Even as far as the organs contained within the torso are concerned, there may be some differential in temperature existing between the various parts of the body.

Dr. Neymann did some very interesting work along those lines, and he has called attention to the close parallelism between the temperature as indicated in the rectum, the liver, the brain, and other parts of the body; but there is a temperature difference, and we have found it most marked in an appendage like the penis. What the temperature, therefore, is in the testes of these guinea pigs and what it is in the human being, is something which would have to be determined with a fair degree of exactness before this question of a possible damage that may be done to the human testes on exposure to such temperature elevation as we use therapeutically.

We owe a great deal to Dr. Giles for making what is a very difficult study and calling to our attention again the possible danger of spermatogenic damage as a result of temperature elevation.

Dr. Upton Giles (closing): In the work of Dr. Jacobson which Dr. Bierman referred to, he told where they gave one hour temperature to rabbits and they did not become sterile; but when they repeated their experiments for a longer time at higher temperature they reported all of them as sterile.

Now Parker has recently repeated his work and found practically the same thing with the high frequency current. It was not by radiant heat that they made the experiment but by radiothermy or the short wave current.

Our idea is not to show that we may be producing sterility in animals or in humans at all. Our report today is only a preliminary report. It was initiated by the fact that seven of our human male patients were rendered sterile by radiant heat. Our experiments covered three years in which we have used radiant heat, high frequency current, in animals, and we are using radiant heat and high frequency current in humans.

We did not have time to give in detail the entire experiment. We will do that later. Nevertheless it is stressed that the high frequency current is not an ideal means of producing heat in animals. When we used rabbits, we got along very nicely with gray ones. Our high mortality is due to the fact that we first used white rabbits, but we soon found them to be unsatisfactory, and later we did not use white rabbits. So if you wish to attempt to duplicate our experiments, do not use the white rabbits, use the gray, because even at lower temperatures the whites are not suitable.

In using rats we ran across the same difficulty encountered by Jacobson and Parker; that is, the tail of the rat is a very difficult medium or resistant to the high frequency current, and before we looked up the literature, when our temperature ran only as high as 103 or 104, these rat tails began to sizzle and literally exploded.

I mention that fact not merely to make an exposé of radiant heat, because that is not our aim. But a good deal of work must be done in radiant heat on humans, because some of our patients, I am afraid, are going to be sterile.

PHYSICAL THERAPY AND OCCUPATIONAL THERAPY IN FRACTURES *

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During the World War, as Assistant Director of the Division of Physical Reconstruction and Rehabilitation of the Disabled Soldier, I was in charge of developing two, to me, entirely new, adjuncts to the then recognized medical and surgical procedures necessary for the restoration of function and rehabilitation of severely wounded soldiers — Physical Therapy and Occupational Therapy. They had mutual aims but functioned independently. Today both are recognized as indispensable aids in civil life for the restoration of function, especially in the severely injured.

One of the aims of Physical Therapy is restoration of function in a disabled member. It is accomplished by the use of heat, massage, and exercise, with certain mechanical adjuncts in special cases. To be successful it must stimulate co-operation and a spirit of "do it yourself" in the disabled patient. Occupational Therapy has exactly the same aim. It utilizes various types of work to accomplish its purpose. This work is a means of teaching the disabled patient certain beneficial exercises, and is the greatest aid in developing his spirit of self-help.

The importance of both Physical and Occupational Therapy in restoring function is best illustrated in severely injured individuals. (The remarks cannot be limited to Occupational Therapy because Physical Therapy of one type or another must be included if the aim of this service is to be accomplished. For this reasoa the assigned title for discussion has been changed by the author to include both forms of Therapy.)

Fractures as an Object Lesson

It is hardly necessary to dwell upon the various types of therapy applicable to the treatment of fractures; or to stress the importance of team work between the surgeon and the technicians; or to re-emphasize the importance of never carrying the treatment to the "pain point" or the "fatigue point."

Abbey and Mock[1] have covered all these points and repetition here is unnecessary. Impink, Spackman, and Lee[2] have so recently published an excellent article upon Occupational Therapy in Fractures that again the reiteration of details here is unnecessary. Hinton[3], in 1929, likewise addressed the American Occupational Therapy Association upon this subject. In this article he states that Occupational Therapy was used in preference to massage and Physical Therapy in the treatment of fractures because of certain complications attributed to the latter. This would indicate a lack of team work between the surgeons and the technicians, otherwise faulty physical therapy methods would not have been used. Again, the point must be stressed that the two are indispensable in properly selected fractures and chronic disability cases. In a great many fractures, neither are necessary.

Twenty years have elapsed since the proper relation between Occupational Therapy was introduced to the rank and file of the medical profes-

* Read at the Joint Meeting, American Congress of Physical Therapy, Seventeenth Annual Session, and the American Occupational Therapy Association, Twenty-second Annual Meeting, Chicago, September 14, 1938.

sion and since then they have become recognized disciples in medicine. Physical Therapy has received more attention probably because it had greater evils to combat. For this reason the American Medical Association organized the Council on Physical Therapy to help save it from exploitation and to guide it along ethical lines. But Occupational Therapy being equally essential has not been sufficiently appreciated by the rank and file.

In my clinic on Occupational Therapy three new internes a few days ago expressed surprise that they had never heard of or seen Occupational Therapy demonstrated in a clinic during their medical course. It is such an important adjunct to both medicine and surgery that I made a pledge to myself there and then that, in my surgical clinic, I would hold at least one clinic every quarter on Occupational Therapy. I plead with every teaching clinician to do likewise. Physical Therapy should receive the same attention. Both are best taught to the medical student by actually demonstrating team work between the surgeon and the technicians.

Physical Therapy is as old as any other braach of medicine. For centuries it consisted of the judicial use of heat, massage and exercise. With the development of the machine age, even medicine became involved in mechanics. During the war there was a craze started for mechanical appliances for the treatment of fractures. Though essential in many fractures, it has been carried to absurdity in others. But today we see more and more surgeons returning to intelligent hand work in fracture management rather than depending so much upon mechanical devices.

Physical Therapy following the war was almost submerged with all kinds of apparatus. Machine therapy became the rage. Manufacturers' agents convinced physicians of the value, sometimes for the patient but usually for the doctor, of this or that device. Certain manufacturers established schools of instruction in the use of their particular apparatus, and many other commercial schemes almost drowned Physical Therapy in the cesspool of quackery.

But the last decade has marked a great change. The dictum that Physical Therapy consists of 90 per cent intelligent hand therapy on the part of a well-trained technician and 10 per cent machine work — needed not in the average case seen and treated by the rank and file, but in certain special cases that belong in the hands of the specialist in Physical Therapy — is becoming more and more an accepted fact.

Even Occupational Therapy was badly influenced by this period of mechanical medicine. It was almost replaced by a system known as Mechanotherapy. I gave considerable prominence to Mechanotherapy in a book published in 1917. Mechanical exercisers still make up a part of the equipment of many Occupational Therapy Departments, but they are rapidly going into the discard.

The automobile is a potential carrier of fractures to every hamlet and village of the land, as well as to our large medical centers, where specialists usually abide and where one expects to find well-equipped departments of Physical Therapy and Occupational Therapy. In discussing this problem, therefore, one must not think of it only in terms of his hospital, where opportunities for the very best Occupational Therapy as well as Physical Therapy may be available. Rather, he must visualize the problem as nationwide, as belonging to the general physicians and surgeons in the smaller communities, who must treat a large proportion of these fracture cases, and offer to them a practical solution of the problem if we expect them to adopt our views on the importance of Physical Therapy and Occupational Therapy in fracture treatment, as well as in the case of other disabilities.

Every surgeon in the land, and every general practitioner in communities where he must be both surgeon to the injured and physician to the sick, is confronted with the following groups of fracture cases:

1. Simple fracture, where reduction and a short period of immobilization are all that is necessary.

2. More severe fracture that is more difficult to reduce; that is adjacent to a joint which may be more or less involved by immobilization of the limb; that, however, is early ambulatory and may or may not require a certain amount of aftercare to restore function.

3. Severe fractures involving the joints; or multiple fractures of the same extremity; or severe compound fractures — often infected; or fractures of the spine with involvement of the cord, resulting in temporary or permanent paralysis; or fractures with involvement of a peripheral nerve, with local paralysis; or fractures accompanied with severed tendons and the numerous other complications which require the most astute judgment on the part of the surgeon if healing of the fracture is to result and the accompanying injury is to be repaired, and if permanent disability is to be reduced to a minimum.

These are the cases which are bed-ridden for weeks and months; whose morale is so frequently broken because of the apparent hopelessness of the situation.

4. Finally, there are a certain number of fracture patients who develop non-union; or whose fractures are improperly reduced, resulting in permanent and disabling deformities; or who have too energetic treatment — for example, too early and too strenuous joint exercises, or even joint manipulations under ether or gas anesthesia, with resulting bony ankylosis; or who receive too prolonged immobilization in a plaster cast or a mechanical splint, with the development of atrophy, circulatory changes and, usually, a soft-tissue ankylosis; or those who develop ischemic paralysis, usually because of a tight-fitting cast — these and numerous other mistakes of judgment in proper treatment which result in the permanently crippled fracture case.

Every surgeon, no matter how great his ability, no matter how conscientious in his follow-up, no matter how accessible he is to the best Physical Therapy and Occupational Therapy, will have a certain number of these cases of permanent disability. This fact is no excuse for any of us to make mistakes in judgment or through ignorance of well-known principles to prevent such disabilities from developing.

Let us consider the above groups from the standpoint of their requirements for Physical Therapy and Occupational Therapy:

Group No. 1 fractures seldom need Physical Therapy or Occupational Therapy. Their period of immobilization is short, and early active movements prevent disabilities.

Group No. 2 fractures, usually ambulatory, often able to carry on at light work, are, therefore, receiving the best form of Occupational Therapy. The use of splints instead of circular casts enables the surgeon to start early massage and assisted-active or active motion in the adjacent joints. Ninety per cent of these cases recover full function without technical Physical Therapy or Occupational Therapy assistance. Ten per cent, however, have stiffened joints; loss of flexion, extension or rotation; or loss of abduction and elevation ability in the case of fractures in or about the shoulder joints; or swollen feet and ankles in lower-leg fractures, or similar complications.

Even this percentage of cases having temporary or permanent complications, and certainly the loss of time, could be reduced if intelligent Physical Therapy and Occupational Therapy were applied early.

Example 1. — A lady, 65, fell and sustained a Collés fracture. She was taken to one of our best university clinics. There a young surgeon reduced the fracture and applied a circular cast. The next day she went home, but reported back to the clinic once a week. Six weeks later she was referred by an insurance company to the author. Why? Because an insurance adjuster recognized that she was receiving the wrong type of treatment.

X-ray showed good alignment and healing of the fracture. Upon removal of the cast, the wrist was very stiff and it was impossible for the patient to flex the fingers. Elbow joint function was good. Shoulder joint function was reduced 50 per cent for abduction and elevation of the arm because of the fact that the patient had carried the arm abducted to her side in a sling.

Physical therapy, consisting of heat, massage and exercise, was immediately instituted — not by me, but in the Physical Therapy Department, where well-trained technicians had the time, equipment and ability to do it properly. Heat to the hand was furnished by a paraffin bath or by a warm whirlpool bath; heat to the shoulder by an ordinary infra-red light or by diathermy. This was followed by a period of massage, usually lasting 20 minutes. Then a period of teaching the patient certain active exercises — active, because she would not carry them beyond the pain point and because she must be impressed with the fact that her ultimate recovery depended upon herself.

From the Physical Therapy Department she went into the Occupational Therapy Department, and here, by use of a light hammer with a handle made to fit her hand by applying plastine or dental wax; by use of a saw similarly treated; by use of an auger and drilling holes in a board which was daily raised higher and higher in order to give more and more abduction and elevation to the arm; and by many other forms of work, her exercises were maintained and increased.

She was taught never to sit down to rest without placing her arm on a table and raising it higher and higher by placing cushions on the table. Even in her sleep the arm was elevated by the use of a sling attached to the bed.

It required four months of treatment before this woman's disability was reduced to a point of 10 per cent of permanency.

All of this could have been obviated by proper splinting and by starting Physical Therapy and Occupational Therapy of exactly the same type early.

Example 2. — A lady, 38 years of age, sustained a slight chip fracture of the tuberosity of the humerus and a slight separation of the acromioclavicular joint while at work.

The first doctor applied a plaster splint about her upper arm and halfway around her chest. The arm was held tightly adducted to the side of her body. This splint was removed daily, the patient placed under an infra-red light and then the splint reapplied. This was carried on for five weeks. Then the patient was transferred by an insurance company to a second doctor.

This doctor removed the splint and had the patient report to his office every day (except Sunday) from May until September for the purpose of receiving short wave diathermy. She carried the arm in a sling for a time and then was told to use it as much as possible. She never was able to abduct or elevate it to a right angle with the body, and the atrophy of the shoulder girdle muscles was marked. Never during all this time did she receive massage; neither was she given occupation that would assist in the much needed exercises.

This patient was then referred to me. I recommended placing her in the hospital for a period of two weeks for proper traction, Physical Therapy and

Occupational Therapy, and stated that the latter two must be carried on for weeks if this patient's disability was to be overcome.

The reply of the insurance company was that they had been paying for Physical Therapy for six months and had gotten nowhere. It was necessary to explain to them the difference between one nonsensical physical therapy maneuver and the intelligent use of all physical and occupational measures in a common sense, ordered and supervised manner.

It is this use of a light, a short wave machine, a mechanical exerciser or similar "cure-all" apparatus in a doctor's office, often operated by his office girl and misnamed Physical Therapy, failing to give results but giving great expense to the patient or whoever is responsible, that has doomed Physical Therapy, especially with many insurance companies.

Group No. 3 fractures will require both Physical Therapy and Occupational Therapy in 75 per cent of the cases. Often the fracture is encased in a body and leg cast, or in a Thomas splint and skeletal traction, or otherwise is so protected that Physical Therapy to the site of the fracture or the affected limb is impossible. Here ingenuity is required to figure out forms of exercise and methods of keeping up joint function, but it usually can be arranged. Often, especially in older people, general body massage is extremely beneficial in these cases. Here Occupational Therapy, often of a diversional nature, can begin to function at once. If it has no particular benefit to the fracture itself, it will do much to keep up general morale and will develop a determination to get well, "to do it yourself," and prepares the patient for that period in convalescence when both Physical Therapy and Occupational Therapy will be necessary to restore function. Failure to utilize Occupational Therapy during this stage in this group of fractures is almost as reprehensible as using a light and neglecting the other, more beneficial forms of Physical Therapy in the above cases.

Group No. 4 consists of fractures with disabilities the result of failures of proper management and proper early use of these two adjuncts. Every such case, or 100 per cent of this group, requires both Physical Therapy and Occupational Therapy if any degree of function is to be restored, if permanent crippling is to be avoided.

Reconstructive surgery, which makes up a considerable part of the author's practice, consists to a large extent of these old fracture disability cases. Occasionally they are ununited fractures, but usually they are joint ankyloses, faulty weight-bearing, paralyses, ischemic or due to peripheral nerve injuries (often from pressure of casts), or simply fibrosed and contracted soft tissues the result of prolonged immobilization. Some of these cases require actual surgery, followed by rehabilitation measures. The majority, however, simply require Physical Therapy and Occupational Therapy measures to overcome or reduce to a minimum the crippling conditions — Physical Therapy measures which, if instituted early and with intelligence, would have completely prevented the need of referring these patients for reconstructive treatment.

Example 3. — A man, age 35, suffered a fracture and partial dislocation of the head of the radius. Slight reduction was obtained, and then his surgeon encased the arm and elbow joint in a cast. After three weeks the cast was removed. The elbow was quite stiff. His interne was instructed to massage and then give passive movements every day. The patient stated that the interne would come in every evening, massage the elbow quite briskly, and then forcibly flex and extend it until the patient broke out in a cold sweat and even screamed with pain. Instead of improving, the elbow

became more swelled and stiff. The patient was then discharged from hospital and reported to the doctor's office for Physical Therapy. This consisted of the turning on of a light on the elbow every other day for five months. No massage, no occupational therapy!

The patient was referred to me at this time. The elbow was ankylosed due to excessive callus and even some myositis ossificans about the site of the fracture in the radius. It was apparent that light therapy from now 'til doomsday would have no effect on this elbow.

Removal of the head of the radius and the excessive callus was done. Physical and occupational therapy were instituted as soon as the wound healed. After four weeks the Physical Therapy was stopped but the patient continued to work in the Occupational Therapy department, reporting as an out-patient, for another two months and receiving heavier and heavier work — all with purposeful exercises. After three months he had 100 per cent function in this elbow.

Every trained Physical Therapy and Occupational Therapy technician today knows the dangers of over-treatment, the importance of "going slow" and never forcefully exercising a joint, especially the elbow. Yet this interne, a graduate of an excellent school, serving under a very reputable surgeon knew nothing — never had heard of such dangers. It was evident that this good surgeon knew nothing of Physical Therapy.

Example 4. — Within the last week I saw a patient with a stiff elbow whose surgeon had recommended breaking up the stiffness under gas anesthesia. Patient desired my opinion if this was necessary. Needless to say, I strongly advised against such a procedure. I have two or three permanently stiff elbows in patients that I so treated in the past. Seldom is any joint benefited by manipulation under gas, and of all joints so treated the elbow gives the worst results. If it is a bony ankylosis surgery alone followed by Physical Therapy and Occupational is necessary — Physical Therapy and Occupational Therapy alone will give little benefit. If it is a soft tissue ankylosis, Physical Therapy and Occupational Therapy, if used intelligently, that is, slowly, satisfied with a small degree of movement obtained each week, will give the best result.

Compression fractures of the spine offer the best examples of prolonged disability due to wrong line of treatment and failure to use Physical Therapy and Occupational Therapy early.

Example 5. — In 1936 I saw a patient in consultation who had a compression fracture of the first lumbar vertebra. There was no cord damage. Hyperextension had been maintained for two weeks with definite improvement in the contour of the vertebra. I agreed with the surgeon's plan of applying a plaster hyperextension cast, but suggested that a large portion of the cast should then be removed to enable massage of the back muscles and that certain exercises and occupations be instituted to preserve function in the numerous joints of the back. The cast was applied but my suggestions were not carried out. Patient wore the cast three months. It was then replaced by a heavy back brace which he wore for a year. At the end of one and one-half years this patient was discharged to go to work. He refused to do so because of pain and stiffness in the back. He was considered a malingerer. Of course he had lost his morale and had developed habits of loafing but he was not malingering.

He was then referred to me. Examination showed that he had soft tissue ankylosis of most of the joints of the spine, due to prolonged immobilization. Physical Therapy and Occupational Therapy were started and

continued for four months, at the end of which time function was restored in his back and he gladly returned to work.

Seldom do my patients with compression fractures wear their hyperextension casts over ten weeks, usually only eight weeks.

Before applying the cast these patients have two weeks of hyperextension both on a frame and by exercises and, daily or twice daily, heat and massage to their back muscles.

After the cast is applied, a large opening is cut in the back of the cast to permit heat and massage. Walking is allowed by the end of three weeks. Exercises and work exercises are carried out every day. Physical Therapy and Occupational Therapy are persisted in until the cast is removed and sometimes for two to four weeks more.

A back brace is never applied to these patients. It has been eight years since I used a back brace on a compression fracture. They are strong and well by the end of eight to ten weeks because of the massage, exercises, and daily work they have received; the fracture is healed — why, therefore, disable these patients again by immobilizing their backs in a cumbersome brace?

Conclusions

1. Physical Therapy and Occupational Therapy are absolute essentials in the management of all fractures that have the potentialities of causing ankylosis, persistent edema, congestion or conditions which, left untreated, may prolong the period of disability.

2. For proper administration, they require thoroughly trained technicians.

3. Every hospital should have these two departments. In smaller communities, with only a small hospital, a technician trained in both Physical Therapy and Occupational Therapy may well meet the situation.

4. When the hospital fails to provide this service, it behooves a group of physicians to band together in organizing these two departments and placing in charge well trained technicians, not an untrained nurse or a good office girl.

5. In either case a physician, thoroughly trained in physical therapy, should be in charge of such departments and supervise the work of the technicians. He should arouse the interest of the other members of the staff or of the physicians and surgeons of his community in true and essential Physical Therapy and Occupational Therapy. The few specialists being trained in this field are in great demand.

6. The time is rapidly passing when an ethical physician can equip his office with one or two pieces of apparatus and use these on his patients under the guise of giving them true Physical Therapy, and remain ethical.

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Discussions

Dr. Frank H. Krusen (Rochester, Minn.): One of the most pleasant and inspiring opportunities I have is on each Thursday morning at our hospital when we make the rounds of all our patients with arthritis. The internist, the physical and occupational therapy technicians, the dietician and I all go around together. Each patient is studied very carefully and each individual offers suggestions. That sort of cooperative treatment is the proper solution of the handling of the class of patients that Dr. Mock discussed which holds good also for the arthritic problem.

A few months ago, while I was in an eastern state to read a paper before a state medical society I was invited to address the staff of one of the largest hospitals in one of our largest cities, and to tell them how to organize a physical therapy department — how to organize one after all these years! I told them for one thing that I was amazed that a hospital of that size had not already organized such a department.

One of the questions that was asked me was, What equipment is used in a physical therapy department? I described some of the various devices, and a very famous orthopedic surgeon asked me, "Well, Doctor, how many of these elaborate devices do you discard after you have used them for a few months?" Well, we do discard new devices that we haven't checked, and in my opening address at this meeting I pointed out that the orthopedist can do much of his work with a few hemostats and a scalpel, but that he also uses drills, saws, and specially constructed orthopedic tables and pins and wag screws and many other complicated devices to aid him in his surgery, but he uses them only when he is sure after a long surgical experience that they are of value.

Most of our work in physical therapy can be done with a little heat and a little massage and skillfully directed exercise and occupational training, but there are certain elaborate devices that we may use after careful trial. I fully agree with Dr. Mock that we should avoid the use of elaborate methods when simple ones will do as well, but at the same time I feel that we should avail ourselves of all devices when they are of use. The objection that I know Dr. Mock has and I have is the inexpert use of an elaborate device principally to make an impression.

The whole problem centers not so much in an array of physical equipment as in knowledge and experience which and when to prescribe.

Miss Henrietta McNary (Cleveland): In a department that is not conducted in a hospital, in one that has been set up in a social agency, to be of service to all the hospitals and private doctors in town, is it sufficient to have a medical advisory board appointed by the local academy of medicine, or would it be more satisfactory to have a medical physical therapist in charge of the department, and what would the referring doctors in that instance feel about having their patients referred and treated under someone else's care?

Dr. Harry E. Mock (closing): I think the idea of furnishing those services in a social center for those who cannot afford to pay for them is excellent. I take pride in the fact that there is no charge made for occupational therapy at St. Luke's Hospital. It is something the hospital provides as an essential part of the curative service. This is not altogether true for physical therapy, because there more medical training and work is brought into play, and a charge is necessary. I think that a department would serve the community best if some physician would develop real specialization in physical and occupational therapy and direct such a department. Under such conditions every physician in that community will welcome the opportunity of having his patients treated.

I should like to stress this point a little farther. We have an excellent Department of Physical and Occupational Therapy for ambulatory patients, such as fracture cases and other disabilities, directed by Dr. Coulter. I refer these patients to his well-equipped office with the understanding that I see them once a week, or as often as necessary, largely to supervise their progress. I lose a certain amount in fees, but, of course, I lose the fee altogether when I send the tonsil cases to the throat specialist or refer certain patients to other specialists. It is the only right way for me to handle my cases requiring physical therapy, that is, to send them to a man qualified to do the work. If Dr. Coulter thinks occupational therapy is also necessary, he sends them down to the hospital for a directed course of exercises.

I have no thought of buying a short wave machine and a lamp and put them over here in a little office to give my own physical therapy to these patients in the future, merely to make fees because, first, I am not trained for it and, second, I haven't the time for it. It is for this reason I am crying out against the flooding of the country with machines. It isn't that I do not believe they are absolutely essential in selected instances, but they must be in the hands of the specialist in physical therapy.

LOW VOLTAGE WAVE CURRENT IN VASCULAR THERAPY

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The use of electricity as a remedial measure is older than scientific electrotherapy. Long before the dosage of galvanic and faradic currents was known, negro women in Western Africa were putting their paralyzed children in water containing electric fishes (Malepterurus electricus), the powerful shocks of which caused movements in the paralyzed extremities. When man placed the organs of the electric ray or the whole fish (Torpedo Marmorata) on aching joints he made the first use of electrodes. Since Remak's[1] fundamental research work "on electrical stimulation of paralyzed muscles and galvanotherapy of neuro-muscular diseases" (1856-58), and Duchenne de Boulogne's[2] "local applications of electricity in pathologic states" (1872), galvanic and faradic treatment has become an indispensable part of therapy.

Since 1900 so-called wave current apparatus have been constructed. They produce current irritation in wave forms. The waves rise and fall dynamically, are regularly interrupted and thus produce contractions which are similar to the natural muscle contractions and relaxations. The first scientific research work was done by Bordier in 1902, who was able to produce a 10 per cent increase in the volume of muscles after rhythmic galvano-faradization of 8 weeks. Bergonié is generally considered as having invented "wave current therapy." Most wave current apparatus are constructed along the lines of his rhéostat undulant. He recommended the low voltage wave current for obesity, putting large surface electrodes on a chair so that the whole musculature was brought into action. But this passive "ergotherapy" although enthusiastically welcomed was a failure, because of which the wave current almost fell into oblivion. Only in 1912, when Becker had constructed a wave current machine providing various gradations, when proper indications had been worked out, and Liebesny (1913) had published his electrophysical studies of the therapeutic superiority of wave currents, it was considered a new and interesting branch of electrotherapy. As a consequence European and American engineers have constructed special wave current machines or accessory ones in recent years. Nussbaum[3] has analyzed in detail some of their deficiencies. Kowarschik[4] recently reporting at length on the various potentialities of wave current treatment has pointed out their uncritical and insufficient administration.

Dosage and Indications

Wave current is the production of a faradic current of about 3-20 ma. that can be administered in dosage as to time (rest period and irritation) and intensity (rise and fall of the wave curve) and produces contractions and relaxations of muscles or tissue parts.

With the possibility of regulating both volume and frequency, "electrotherapeutic exercises" can now be carried out. These are applied to the extremities by special electrodes. As the "muscle pump" thus produces massage in a centripetal direction and thereby relieves peripheral tissues apart from the direct muscle exercise, the following indications are given for this mode of treatment:

1. Disturbances of the peripheral vessels, particularly veins, venectasia, varicosities, chronic thrombophlebitis and congestion (frozen feet).

2. Weakness and paralysis of the musculature of the extremity (posttraumatic and postinfectious atrophy, particularly after poliomyelitis).

3. Metabolic disturbances (myogelosis), effusion of joints periarticular swelling and edema. Fatigue (static myalgia due to strained feet).

Kowarschik recommends "electrogymnastics" as a curative in fallen arches, bladder and abdominal wall atony and progressive muscular dystrophy. With such diseases we use small metal electrodes which can be folded to any desired size, instead of cuff electrodes which we shall describe later on.

The galvanic current can be converted into wave form and enhances the treatment of physical and psychic excitability (neurasthenia, migraine and neuralgia). Cataphoretic histamine and acetylmethylcholin treatment of peripheral circulatory disturbances (Kovacs,[5] Kling,[6] Bettmann[7]) is rendered more efficacious by subsequent wave current treatment as tissue massage. The treatment of arterial disturbances (arteriosclerosis, thromboangiitis obliterans) which has been extremely furthered by the depressor and pressor method of the "Paevex-therapy" elaborated by Herrmann to create a secondary circulation in vascular derangement, is effectively enhanced by wave current therapy. The same may be said about the compression boots used as early as 1904 and similar methods described by Bräucker, Schede and Bettmann.

Methods

The primitive methods of breaking the current roughly with an electrode interrupter, the manual change of the rhythmic distance between the secondary coil and the iron core, and the mercury interrupter combined with a metronome, the latter being often used in England, produce disagreeable shock-like breaks which wave curves in exact dosage do not. The rheotrope used in Germany but no longer constructed, also results in breaks resented as shocks, while the tonisator because of its falling and spasmodic currents has an uncoordinated course and is limited in strength. J. Weiss[8] has produced a "flasher sinusoidal apparatus" for rhythmic stimulation, which has proved very useful.

A perfect wave current apparatus has to meet the following conditions:

1. Connection with any street current.

2. It must provide for separate regulation of current intensity and wave velocity with the irritation frequency of the faradic current unchanged.

Our apparatus known as "Electro-Exerciser" meets the above outlined demands as substantiated by trial on 500 patients and personal experiments. Any kind of treatment with galvanic currents or faradic ones alone or in wave form is possible.

Through a freely swinging pendulum acting as an interrupter, regular breaks (according to the circuit frequency about 160 to 200 per second) are brought about. They generate a perfect faradic dropping current. A cam specially calibrated and having a ring arm traveling on a contact segment represents the wave instrument which produces regular wave curves up to 16-62 waves a minute. The universal "cuff electrode" (figs. 1, 2) facilitates the treatment of extremities. They are of simple and inexpensive metallic cloth 2 yards long and 4 inches wide. The extremity which is to be treated is first covered by a moist orthopedic stocking and then wrapped with the electrode cuff which is bound to the extremity by two ties. If only one extremity is to be treated, the folded electrode covered by a moist cloth is

Fig. 1. — Treatment of thrombophlebitis of both legs with cuff electrodes and wave current.

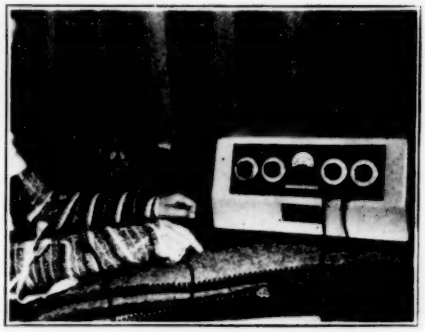

Fig. 2. — Treatment of Acrocyanotic arms.

used as an indifferent one. The electrodes perfectly replace the four-cell bath and render possible treatment of bedridden persons (fig. 2).

We generally administer treatments from 20 to 30 minutes once every second day to two treatments daily according to the case. Wave intensity and frequency are adapted to the patient. The optimum is one wave every other second or 30 per minute. In some cases of circulatory disturbances (frozen feet, acrocyanosis) wave current therapy was preceded by cataphoresis.

Subjectively all patients felt their extremities considerably relieved for several hours or more. The same was experienced in self-experiments (overcoming of fatigue). Objectively a decrease of venous congestion could be proved after the first administrations. There was no longer cyanosis but rather the color of normal circulation. Congestive edema was absorbed more rapidly than with other methods. A decrease of the circumference by 1 inch could be seen after a treatment of 30 minutes. Paresthesia and "dead fingers" were favorably influenced. Four non-febrile cases of thrombophlebitis were improved after 4 to 6 carefully dosed administrations. Muscular atrophy was favorably affected in the sense of improved function.

Contraindications to be considered are limited according to our present experience to febrile vascular diseases (phlebitis) and inflammatory diseases of the skin.

Conclusion

Wave current therapy in combination with cuff electrodes is an efficacious vascular and tissue massage decreasing venous congestion and edema and stimulating the function of muscles. Patients can be treated even when bedridden. Various combinations of the treatment are possible.

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Fever Therapy in Ocular Diseases — Berris and Newman

(*Continued from page 618*)

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.·. EDITORIALS .·.

SHORT WAVE DIATHERMY IN GYNECOLOGY

In contrast to the rather limited applicability of conventional diathermy, short wave radiation has recently been established through noteworthy research and clinical experience as offering a wide and fruitful field in a great variety of gynecologic affections. Apart from the quasi-surgical use of diathermy in endocervicitis and other localized processes of the genital apparatus, to which could be added the various methods of pelvic hyperpyrexia for gonococcic infection, there is now definite evidence of the effectiveness of properly dosed short wave application in more or less generalized diseases of the female pelvis which in the past have proved recalcitrant to classic measures and even to x-radiation. Thus the old bugbear of gynecologists, namely, the acute and chronic inflammatory processes of the uterine adnexa and parametrium are now shown to be favorably influenced even by so simple a procedure as dorso-ventral radiation with short waves.

Another method of application which has therapeutic value is transcerebral radiation of the hypophysis in certain types of menstrual disorders. Both dysmenorrhea and amenorrhea ascribable to endocrinic influences have been greatly benefited by hypophyseal radiation, so that failure of this procedure clearly indicates either form of menstrual disturbance to be based on some organic lesion or condition. Of perhaps lesser importance but worthy of consideration is the treatment of puerperal mastitis by direct radiation of the affected breast. It has been shown in many instances that if this treatment is begun at the first appearance of inflammation, the process is caused to retrogress and as a corollary the stage of suppuration which necessitates surgical intervention is prevented. From what has been stated it is evident that this form of treatment has already found a large field of usefulness, and when one considers the underlying factors it can be asserted that this measure will in the not distant future find even greater clinical recognition.

Reverting to the problem of dosage the generally prevailing concept that the apex of tolerance represents the reliable index of administration must be rejected as fallacious and under certain circumstances also as harmful. It is of course unfortunate that at this time an appliance of exact measurement of the current within the human body is not generally available — though this soon will be — and that one is forced to rely on subjective sensation of the patient. Variable though this is in different individuals who do not suffer from certain lesions of the nervous system interfering with normal caloric sensitivity, it has proved fairly adequate as a guide in actual clinical practice. It is not difficult to differentiate between mild and intense heating in the overwhelming majority of cases, and the only problem is to determine when very mild and when stronger dosage is applicable for their desired effects. Overheating of even such delicate organs as the ovaries is virtually impossible with ordinary precautions. Studies by Raab[1] have shown that while many cells are thermoresistant others lack that power and therefore are likely to be damaged at least for some time, but the same observer has definitely shown that in due time these cells regenerate so that they cannot be differentiated from normal ones.

But apart from these finer histologic observations it is a clinical fact that conventional diathermy, for example, is contraindicated in acute inflammatory

and suppurative processes. The literature is replete with statements that this contraindication does not hold good for short wave therapy. Yet not only failures but positive exaggeration of these processes has been noted. As a result the method has been decried when in reality the fault was with the concerned physician who did not know or realize that in the acute stages under discussion only moderate intensities are productive of a favorable influence on the processes. It is not unlikely that many have been misled into believing that intense doses are required to overcome many inflammatory conditions of say the articulations or nerve sheaths, but as a matter of fact overdosage is to be avoided under any circumstances, and this holds especially good for acute and even subacute processes of the pelvic organs of both sexes.

Comparison with the results of present-day artificial fever therapy is highly fallacious. It should be borne in mind that in this therapy virtually the entire body is subjected to the influence of radiation and that the rise in temperature proceeds comparatively slowly and to a great extent is equalized by the cooling effects of the circulation. When, however, merely a limited region such as the pelvis, is so treated, we obtain concentrated effects and the locally increased circulation is unable adequately to cope with the rapid and accumulating effect. By way of illustration it is emphasized that the mere omission to have the patient empty her bladder before starting pelvic radiation with short waves will almost invariably bring about a hyperemization of that viscus manifesting itself as an annoying cystitis. The reason is that the urine is an excellent electrolyte. This applies even more to encapsulated exudates in the lower abdomen, so much so that short wave radiation can only cause a modicum of harm when applied for ovarian cysts or parametritic abscesses, which still remain subject to surgical operation.

Increased dosage is, of course, applicable in afebrile inflammatory processes of long standing and here the results are all that one can desire. It is astonishing how infiltrative processes disappear within the course of a few weeks, so that they can no longer be demonstrated by bimanual palpation, to say nothing of the decided subjective improvement gladly admitted by the patients who have derived no benefit from the long continued use of douches, tampons and cataplasms.

So far as the scientific background of hypophyseal radiation is concerned it will be recalled that among the six or eight hormonal substances separated from the anterior part of the gland and tentatively accepted as specific in chemical extract, the gonadotropic or sex hormonal influence ranks as most important in the light of its physiologic and clinical implication. The fact that hypophysectimized young animals soon manifest undeveloped sexual organs and that adult animals so treated show retrogression and maturation of germ cells with inhibition of gonadal activity eventually led to the appreciation of the important relationship between the human generative organs and the pituitary gland.

Extracts of a sex factor demonstrated by Zondek,[2] Smith[2] and others definitely established the presence of a hormonal or autocoid substance belonging to the anterior lobe of the pituitary, while the discovery that substances with similar action could be extracted from the placenta, amniotic fluid, blood and urine of pregnant women became the basis of the Ascheim-Zondek test for pregnancy. Theoretically at least one can appreciate the important functional, physiologic and clinical possibilities inherent in a method of thermopenetration stimulating, inhibiting or regulating genital functions via the hypophysis. Apart from this influence on certain types of amenorrhea and dysmenorrhea one finds here also an opportunity to exert a more or less direct influence on the manifold phenomena appearing during the trying period of the climacterium. To date transcerebral radiation of the hypophysis with exceedingly mild dosage has already been reported[3-4] as ameliorating the distressing symptoms associated with the menopause.

Finally it is not only the physical therapist but every gynecologic surgeon who should be thoroughly familiar with the technic and indications of short wave radiations. How many surgeons have not been exasperated by the long continued complaints of patients that they suffer from pain following some major surgical operation, such for example as hysterectomy, myomectomy or extirpation of the adnexa. In such cases where these pains are demonstrably due to exudates and infiltrations proper short wave radiation in most instances relieves and even overcomes them by a comparatively few treatments. But it is essential to point out that this therapy to be successful presupposes not only judgment with respect to dosage but also with the methods of application. Thus the selection of electrodes, their proper adjustment over the *entire* lower part of the pelvis, the extent of air spacing, and last but not least, the proper use of vaginal electrodes are of greater importance than is commonly believed. The principles are the same for gynecologic therapy as those governing other parts of the body, provided they are modified to suit the anatomic peculiarities. This knowledge is a prerequisite, but once it is possessed short wave radiation will become a therapeutic measure in many gynecologic conditions which no one can afford to omit from his armamentarium.

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THE SEVENTEENTH ANNUAL MEETING

This year's annual session of the Congress which recently closed at Chicago has been one of the most successful from many points of view. The seminar which preceded the convention proper was well attended, and from all reports received has been appreciated as one of great practical usefulness both to physicians interested in the latest technical advances in physical therapy and to their progressive technicians in good standing. Since the didactic and clinical lectures will shortly appear in permanent form, those who have been unable to participate in this intensive course of instruction will have an opportunity to become familiar with the subjects and their presentation by a select body of specialists.

The Chicago meeting differed from preceding ones therein that the American Occupational Therapy Association joined forces with the Congress, which naturally greatly increased the number who registered for attendance and reflected the dual scope of the past year's progress. But apart from this, the combined program aided in bringing about a better understanding of the aims and attainments of certain corrective efforts under special supervision spoken of as occupational therapy for the rehabilitation of those unfortunates who become handicapped through disabling diseases and affections; while those devoting their energies to this phase of therapy were afforded an opportunity to appreciate the effectiveness of physical therapeutic measures in general medicine and surgery.

The program having been published in the ARCHIVES there appears to be no need of expatiating on its value. It must therefore suffice to state that most of the addresses and papers that were presented elicited lively, sometimes even

heated discussions, so that those who followed the proceedings obtained the diverse findings of essayists and discussants from various points of view.

The banquet was unusually well attended. This event was also a particularly happy occasion since under the genial and tactful guidance of President Krusen as toastmaster the various speakers were not only appropriately introduced but every such occasion was utilized to create an atmosphere of intense interest and enjoyment. The principal speaker of the evening, Dr. Morris Fishbein, editor of the *Journal of the American Medical Association*, combined scintillating wit with broad philosophy, and it was heartening to hear his evaluation of physical therapy in relation to scientific medicine.

The scientific exhibits were more numerous than those of the preceding annual conventions and of a highly interesting and informative character. There were so many excellent exhibits that the Committee on Awards had great difficulty in singling out those meriting the three medals and a certificate of honorable mention. However, the limitation of these coveted prizes imposed restriction and the committee under the chairmanship of Dr. William Bierman finally made decisions which received unanimous approval. The list of the exhibitors so honored for outstanding merit is published elsewhere in this issue.

The technical exhibits, too, were large in number and brought to the attention of the members and visitors many innovations and improvements which had been developed since the last meeting.

The Committee on Gold Key Awards under the chairmanship of Dr. R[illegible] W. Fouts had carefully weighed a number of recommendations of American and foreign savants who have made valuable contributions to physical medicine. The fact that only three were selected although no restriction was placed on the number, clearly shows the care exercised by the committee in the determination to maintain a high standard of achievement for the bestowal of the highest honor within the gift of the Congress. Two Americans and one Belgian have been cited for a distinguished place in our hall of fame. Their names and citations are also published in this issue.

For the past years the problem of rendering the annual meetings in keeping with the steady progress of physical therapy has been an increasingly difficult one. The question of physical accommodation alone, is one demanding exacting labors. Space and equipment for the extensive scientific and technical exhibits set to their best advantage also represents considerable thought and investigation. But the principal feature concerned after all is centered in the scientific program. It is but natural that many clamor to present their experiences before their immediate colleagues and it is no easy task to examine into the merits of the individual addresses, for their number must be restricted because the Congress has neither the time nor the opportunity to lend ear to claims that have not stood the test of trustworthy experience. While many investigators can be relied upon to bring worth-while contributions, it is felt that even newcomers in the field should not be deprived of an opportunity for a hearing, provided of course their studies or observations measure up to scientific demands. The lion share of the credit for the success of the annual conventions goes to Dr. Abraham R. Hollender, both as chairman of the convention committee and as executive director of the Congress for his onerous and careful labors, but the various committees represented by Drs. Coulter, McGuinness and others also share in the responsibility and much credit is due them for their readiness to do all in their power to maintain the reputation and dignity of the Congress as a scientific organization of national, nay, international scope. There is no gainsaying that the 1938 meeting has lived up to tradition. However, it marks only a milestone in the search for scientific truth and already one may look forward to the next year's convention in New York as one that will open new paths for the eternal march toward perfection of our discipline.

AWARDS OF MERIT BY THE AMERICAN CONGRESS OF PHYSICAL THERAPY FOR THE YEAR 1938

In compliance with established custom the Board of Governors of the Congress after due and careful deliberation have awarded the Gold Key of Merit as a token of appreciation of outstanding labors in the furtherance of Physical Medicine to one scientist in Belgium and two scientists in America. This the highest award which automatically carries also honorary membership in the Congress was presented with the following citations:

Henry C. Bazett, distinguished son of Pennsylvania, Professor of Physiology, Medical School, University of Pennsylvania, for his pioneer contributions in the physiologic action of heat.

Albert Bessemans, distinguished son of the Kingdom of Belgium, Pro-Rector, Director of the Institute of Bacteriology and Hygiene, and Professor of Bacteriology, University of Ghent, for unusual contributions in the study of electropyrexia and chemotherapy.

Harry E. Mock, distinguished son of Illinois, Associate Professor of Surgery, Northwestern University, Chairman of the Council on Physical Therapy of the American Medical Association, in recognition of his pioneering work in the field of electrosurgery and for his onerous and fruitful labors in the cause of physical therapy.

AWARDS TO SCIENTIFIC EXHIBITORS

The Jury of Awards for Scientific Exhibits presented through its Chairman, Dr. William Bierman, the following awards:

The Gold Medal to Dr. *Philip Lewin*, of Chicago for excellence in an exhibit clearly showing the intimate relation between orthopedic surgery and physical therapy.

The Silver Medal to Dr. *O. L. Huddleston*, of the University of Colorado, for excellence in demonstrating pulse tracings and cardiac activity during artificial hyperpyrexia. The same award goes to Dr. *Frank H. Krusen* of the Mayo Clinic, Rochester, and to Dr. *E. J. Baldes* who collaborated with Dr. Huddleston.

The Bronze Medal was awarded to the American Occupational Therapy Association for informative exhibits demonstrating virtually the entire range of occupational therapy.

A certificate of Honorable Mention was presented to Dr. *Charles I. Singer*, of Long Beach, New York, for an excellent array of graphic presentations dealing with the therapeutic effects of the climate of littorals.

SCIENCE, NEWS, COMMENTS

Dr. Mittleman Addresses Institute of Radio Engineers

The Chicago section of the Institute of Radio Engineers had as their guest speaker on the evening of Friday, September 30, Dr. Eugen Mittleman of Vienna, to address this highly specialized audience on a very technical branch of physical therapy, namely, "Short Wave Therapy as a Technical Problem." The speaker reviewed the operating conditions essential for short wave generators, the measurement of power delivered to, and measurement of power absorbed by the treated object. There was also demonstrated and described a direct reading unit that could be attached to any short wave apparatus which was shown to measure the energy introduced into and through the treated part in exact dosage. The observations and conclusions drawn from this study of power measurement represented the major topic of the evening.

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Dr. Kovács Moves to New Office

Dr. Richard Kovacs of New York announces the removal of his office to 2 East 88th Street. It is understood that these new quarters represent in equipment and protection against the many hazards associated with practice, the latest and best known to science. For instance the problem of radio interference, static and high frequency control has been considered and protected against the present recognized hazards and objections. His friends wish him success and contentment.

Obituaries

It is with sorrow that we reflect the news of the demise of two of our most distinguished and progressive members of the Congress — Drs. *Leroy Watkins Hubbard* and *Maurice Farvish Lautman*. We voice the grief of our members and readers and extend condolence and sympathy to the respective bereaved families and relatives. In their life span both contributed brilliantly to the knowledge in their respective fields and gained the respect and love of their fellow men.

Leroy Watkins Hubbard was born at Mount Vernon, New York, in 1857, and graduated from the University of the City of New York, medical department, in 1883. Later he became associated with and director of the extension work of the Warm Springs Foundation in Georgia, where as Chief Surgeon he treated many notable patients including our first citizen, President Franklin Delano Roosevelt. For his outstanding contributions in the field of hydrotherapy in relation to anterior poliomyelitis, the American Congress of Physical Therapy awarded him the Gold Key of Merit for the year 1934. Dr. Hubbard died on August 31 at the age of 81 from arteriosclerotic heart disease and coronary occlusion.

Maurice Farvish Lautman was born at Hot Springs National Park, Arkansas, in 1890, and graduated from Yale University School of Medicine, New Haven, Conn., in 1911. In the course of his career he became consultant to the U. S. Public Health Service Clinic, served in the World War and eventually specialized in the treatment of arthritis. As a staff member of the famous Levi Memorial Hospital at Hot Springs he had ample opportunity to pursue and develop his knowledge in the problems associated with arthritis. His recent book, "Arthritis and Rheumatic Disease" was well received by the medical profession. He died at the age of 48 on September 24, of coronary thrombosis.

New York Physical Therapy Society Meeting

The regular October meeting of the New York Physical Therapy Society will be held at the Einhorn Auditorium of the Lenox Hill Hospital, October 12 at which the following program will be presented:

1. "Modern Concepts of Dosage in Short Wave Diathermy," by Norman E. Titus, M.D.

Discussion will be opened by Myron Schwarszchild, George Mantell, Harry Ernest, Myron Brachman, and Egbert Von Lepel.

Catalase, Mystery Stuff of Cells, Is Crystallized

Catalase, a "mystery" stuff apparently present in all living cells yet whose use in life is not known, has been obtained in pure crystalline form for the first time by Drs. James B. Sumner and Alexander L. Dounce of Cornell University.

Catalase belongs to the group of complex organic substances called enzymes. Enzymes promote certain specific chemical reactions within the body. Common enzymic reactions are the digestion of proteins by pepsin, the changing of starch to sugar by the enzyme amylase.

One interesting and possibly significant fact is that the crystals contain iron, in concentration approximately one-tenth of one per cent. The oxygen-carrying respiration enzyme of the blood discovered by the noted German chemist Prof. Otto Warburg about a decade ago is also believed to contain iron. Further research will disclose what relationship may exist between catalase and the respiration enzyme and catalase. — *Science News Letter.*

Chow Mein Demonstrated As Good Vitamin Source

Chow mein, stand-by of Oriental restaurants, may be unknown in China, but it is an excellent source of vitamins and a balanced meal in itself. This was revealed in a paper reporting the studies of Dr. LeRoy S. Weatherby and S. Murray of the University of Southern California, read before the American Chemical Society meeting at San Francisco.

Five white rats were fed on a diet of chow mein exclusively for six months after weaning. They showed no diet deficiency during the entire period and grew normally, although a trifle more slowly than rats fed on other balanced diets.

This slight slowness in growth was probably due to the composition of chow mein, the investigators believe, which is 82.36 per cent moisture, and consequently lacking in solid matter.

Other experiments with groups of white rats showed that chow mein is not only rich in Vitamins A, B and D, but is also sufficiently supplied with minerals and proteins necessary to health.

Five grams of chow mein a day, in addition to a basal diet, was fed to each rat in several groups.

In the first group, it was sufficient to produce a normal growth curve for each rat. A gain of 4.5 grams in weight a week, for eight weeks was recorded for each rat in a second group, together with the disappearance of nervous symptoms present before the test. Complete cure of rickets was effected in four weeks in a third group.

If chow mein will produce similar beneficial effects in humans, as is to be expected from the animal tests, Chinese restaurants will have another good argument in soliciting patronage. — *Science News Letter.*

Coffee Becomes Stale Through Action of Oxygen

Coffee goes stale as it grows old because of the action of oxygen on the aromatic fatty substance in the beans that is responsible for their delicate flavor. It is a process analogous to the spoiling of butter. The only thing you can do about it is be sure you get freshly roasted coffee.

These results of research in coffee chemistry were reported before the meeting of the American Chemical Society by Dr. Robert O. Bengis of Yale University.

Experimental procedure followed by Dr. Bengis was basically simple. He extracted the fatty substance from a lot of freshly roasted coffee beans, and later on made a similar extraction from beans out of the same batch, when they had gone stale. Each sample of the extracted substance he exposed to oxygen, in an apparatus that would show how much of the gas the sample absorbed. The fresh material absorbed more than did the extract from the stale coffee, showing that the latter had already taken up a measurable quantity of oxygen, during the process of staling.

Similar tests on coffee marketed in vacuum tins showed that this method of packing affords only partial protection to the coffee. Even with the best of commercial vacuums, there seems to be some air left — enough, at any rate, to start oxidation in the aromatic fatty substance. Vacuum packing therefore, in Dr. Bengis' opinion, serves only to retard the staling process and will not stop it altogether. — *Science News Letter.*

Conference of French League Against Rheumatism

The French League against Rheumatism met in a one-day clinical meeting held on October 8, partly at the Hospital Cochin and partly at the medical faculty of the University under the presidency of Professor Laignel-Lavastine. The program contained five papers mostly dealt with the evaluation of mediditions, a few short clinical reports and demonstracal, surgical and physical therapy of rheumatic contion of patients. The "Secretariat de la Ligue Française contre le Rhumatisme" may be addressed at Paris, (VI), 23 rue du Cherche-Midi.

50,000 atmospheres and upon occasion to reach the tremendous pressure of 1,000,000 pounds to the square inch or 70,000 times the ordinary pressure horn-like material.

Formerly routine tests were confined to about 12,000 atmospheres and the absolute maximum was about 40,000 atmospheres, at which point the heavy steel sides of his confinement chamber bulged like lead and made measurements impossible.

At these terrific new pressures, higher than scientists have ever been able to reach before. Dr. Bridgman has been able to force atoms and molecules of some substances to take up permanently new positions, thus creating new forms of matter previously unknown to science.

In addition to the new apparatus for these pressures, Dr. Bridgman has also used a new tool for the creation of terrific stresses to "twist" the various atoms and molecules into their new positions, which has cast new light on the so-called shearing laws of solid matter. These unusual pressing and twisting tools are believed to approximate much more nearly than has been done before the tremendous pressures and strains hundreds of miles below the surface of the earth.

Already three new kinds of solid bismuth have been found, one new kind of mercury, one of gallium, two of tellurium and a number of others, Dr. Bridgman announced.

1. Rubber was derubberized into a translucent
Moreover, Prof. Bridgman found that under high pressure plus twisting:
2. Paper was similarly transformed.
of the atmosphere.
3. Wood and linen cloth were changed in comparable fashion.

Dr. Bridgeman said:

"It is found that the force required to shear practically all substances under high pressure is very much greater than would have been expected from previous ideas. What is more, the possibility of internal slippage is so diminished that a number of substances which are normally soft may become harder than glass-hard steel in certain directions and produce deep scratches in the steel.

"This is shown particularly well by graphite, which under ordinary conditions is so soft and slippery that it makes an excellent lubricant. In a special apparatus this was subjected to a pressure as high as 100,000 atmospheres, or one and a half million pounds per square inch. Under these conditions it became so hard that it embedded itself in the glass-hard steel just as a diamond would have done. There was no permanent change, however, although a change to diamond might have been looked for because diamond is a dense form of graphite, but on release of pressure the graphite resumed its normal soft slippery state." — *Science News Letter.*

Insulin Cuts Short Circuits in Brain of Mental Patient

Insulin shock treatment is banishing hallucinations and clearing up befogged minds of mentally sick patients by isolating short circuits in the brain which are responsible for the mental confusion, Dr. Manfred Sakel, Viennese psychiatrist who discovered the new treatment, explained to members of the American Psychiatric Association meeting at Pittsburgh.

The particular mental disorder for which Dr. Sakel introduced insulin shock treatment is schizophrenia, also known as dementia precox. Psychiatrists estimate that 100,000 persons suffer from the disease in the United States alone.

The insulin shock treatment also works on narcotic addicts, aiding in the difficult process of weaning the addicts away from the drug they love. Instead of being morose and mentally disturbed after the drug is taken away they become extremely friendly and interested in the world around them. The new treatment was first discovered by accident during treatment of a drug addict who had diabetes. Insulin, a gland extract, has been the standard treatment for diabetes for over a decade.

Giving insulin, the diabetes remedy, to the schizophrenic patients in doses large enough to reduce the amount of blood sugar almost to the point of collapse, banishes the hallucinations and restores their sanity. Dr. Sakel reported that this treatment had succeeded in bringing 80 per cent of the patients back to a normal mental state.

The mystery of how insulin shock treatment accomplishes this was explained by Dr. Sakel on the basis of a new theory of the cause of the disease.

Stimuli coming to the brain from sense organs, such as the eyes and ears, probably travel along pathways from one brain cell to another, Dr. Sakel suggested. Injury at any point may distort and confuse the pathways. Then the stimulus, coming from eye or ear or other sense organ, loses its way or is short circuited.

When the stimulus comes in over the short circuit or false pathway, the brain's response may consequently be false. This would explain the hallucinations of the mental disease. A stimulus that should have come, say, over the pathways from the eye got short circuited along the way and arrived on the pathway from the ear. The thinking part of the brain received it as an ear stimulus and the patient heard voices that did not exist.

When the blood sugar is lowered by insulin, the false new pathways or short circuits are isolated, Dr. Sakel believes. This banishes the hallucinations.

Because the false pathways are the most recently formed ones, they are most easily isolated. When the false pathways have been in existence for a long time, as in mental cases of long standing, it may not be possible to isolate them. This probably explains why the insulin treatment is more effective in acute, newly developed cases of schizophrenia than chronic ones and in young rather than old patients. — *Science News Letter.*

THE STUDENT'S LIBRARY

TRAITÉ D'ÉLECTRORADIOTHÉRAPIE. Publié sous la direction de *L. Delherm* et *A. Laquerrière*. *H. Morel Kahn*, Secrétaire Général, *H. Fischgold*, Secrétaire Adjoint. Two octavo volumes. Pp. 2018, with 450 illustrations. Price, bound Fr. 480, paper covers Fr. 440, exclusive of 45 francs for postage. Paris: Masson & Cie, 1938.

When it is considered that no less than 92 French or French speaking physicists, electrologists, radiologists, neurologists, surgeons and internists have contributed specialistic essays, it will be appreciated that the designation "treatise" is not appropriate for this unusually large two-volume work. Yet editorial liaison under Morel Kahn has assured a well-organized presentation of every conceivable aspect of electricity and radiation in the service of modern medicine and surgery. One may also assert with propriety that the title is inadequate since other physical agents, such as crymotherapy, mechanotherapy and others have been made subjects of special discussion. The work brings as a frontispiece an excellent photograph of Professor d'Arsonval and a handwritten letter of the master in facsimile, which may well be regarded as giving the *leitmotif* of this encyclopedic work. The text proper begins with a brief historic review and introduces the reader to the general properties and biologic effects of electric currents and the diverse forms of medical radiation. The following 1,041 pages of the first volume contain no less than 45 essays dealing with the nature, properties and clinical effects of all known agents and methods of electricity and radiation as applied to the diagnosis and treatment of numerous diseases and affections. The second volume is devoted to clinical consideration in a more special manner and includes such a variety of subjects as diseases of infancy (7 essays) respiratory, cardiovascular and blood diseases, affections of the connective tissue and lymphatic systems, digestive disorders (19 essays!) affections of the male and of the female genital organs, inflammatory processes, tropical pathology, the determination and removal of foreign bodies, electrosurgery and the like. Finally the specialties of otorhinolaryngology, ophthalmology and stomatology are treated in a separate section.

The list of contributors contains many names known to American physicians, of whom we mention only such renowned authorities as Biancini, Bourguignon, Coutard, the late Dr. Dausset, Duhem, Mallet, Rechou, Roucayrol, Solomon, Vignal and Vincent. As is to be expected from such an array of authoritative writers many of the chapters are not only highly informative but even exhaustive. The majority of the clinical entities are discussed with regard to their etiology, pathology, diagnosis and accepted medical and surgical therapy, after which either electrotherapy or radiotherapy or both are described in a critical manner and evaluated in relation to the former — a very valuable arrangement.

It is, of course, virtually impossible to convey detailed impressions of the considerations presented in this admirable literary enterprise, yet we are constrained to point out certain defects which, it is hoped, will be remedied in future editions. Thus in the essay on electrosurgery, the section devoted to its history fails to mention the name of Rivière, generally considered as the unquestioned pioneer in the application of the high frequency currents to surgical conditions. Again it may be patriotic to stress the labors of French colleagues and omit foreign names that should have been incorporated in a well rounded out encyclopedia, but when the introduction of intravesical fulguration of papillomas of the urinary bladder is credited to Heitz-Boyer instead of the late American urologic surgeon Edwin Beer, then one is confronted by a chauvinism which has no place in science. The work shows also a very peculiar paucity in literary references. Many essays have none and others only a very few, so that the student searching for sources of collateral reading will have to seek elsewhere for the desired bibliography. Again it is not considered good scholarship when foreign names are mispelled, especially those of international reputation. Of especial interest will be the contribution by the late Dr. Dausset, whose original studies of the endocrine system by observations of certain blood changes fully substantiate the claims made by Samuels, of Amsterdam. Finally certain of the articles present more space than is justified by the importance of the contents. Apart from these shortcomings the editors deserve great credit for their onerous task of securing an unusual amount of practical material for the application of electroradiotherapy.

THE MACHINERY OF THE BODY. By *Anton J. Carlson* and *Victor Johnson*, of the University of Chicago. Cloth. Pp. 580 with 187 illustrations. Price, $4.00. Chicago: The University of Chicago Press, 1937.

This volume represents an advance in the method of instruction of college students in physiology, and is the result of the combined experience of one of the foremost physiologists in America and his coworker in one of our leading universities. Intended as an elementary text for college freshman and the lay reader, but no less pertinent in content for the general practitioner's physiologic orientation with many of his clinical problems, this rather comprehensive exposition on the mechanism that regulates the normal living body during its adjustment to external environment introduces the most lucid, rational and detailed method thus far provided in the teaching of physiology. To safeguard against dogmatism, it avoided brevity without sacrifice of de-

tail; to safeguard against interpretation of controversial theories as factual experience, the authors have introduced clarity and understanding by stimulating curiosity and energizing interest through experimentation, demonstration and the written word. Physiology is here represented as a science built on experimentation, hence pure description and the recounting of details play a secondary role to the laboratory tools that make clear the principles governing the normal activities of the body. What makes this work attractive to the beginner or the individual who wishes to obtain authoritative information is the non-technical style utilized in the presentation of the important and salient facts of this discipline. While didactic emphasis is laid on human physiology, it clearly supports the relationship and functional similarity to that of animals. The thirteen comprehensive chapters conveys the reader through the fundamentals of physical and biological proof of the normal reaction and of every organ, including that of endrocrine glands as well as to point out the significance of body defenses against disease. This work is warmly recommended to practitioners as highly informative, lucid and authoritative, contributed by two of its most distinguished teachers and contributors.

RÖNTGENDIAGNOSTIK DER KNOCHEN — UND GELENKKRANKHEITEN. von Professor *Dr. Robert Kienböck*, Vienna. Heft 1. DIFFERENTIALDIAGNOSE DER GESCHWULSTIGEN KNOCHENKRANKHEITEN. (Pp. 104 with 26 illustrations. Price, Rm. 8.50.) Heft 2. KNOCHENECHINOKOKKOSE. (Pp. 187 with 19 illustrations. Price Rm. 7.60.) Berlin and Vienna: Urban & Schwarzenberg, 1933.

It is with regret and due apology to both the distinguished author and the publisher that the editorial department through circumstances beyond control, has been unable to have these two numbers reviewed within a reasonable time after their appearance. As a matter of fact time has only added to the value of these publications, for the findings of Professor Kienböck have since been supported by other investigators. The two issues are paper covered but placed in carton folders for eventual binding when the series shall be completed. They represent to all intents and purposes both a radiographic atlas and textbook. The first volume is an exhaustive study of certain neoplastic diseases of the osseous system, while the second is restricted to observations which have been unquestionably demonstrated as echinococcus of the bones. The value of this book is not limited to a mere study of x-ray pictures, for it encompasses diagnosis also from the clinical point of view. It is astonishing how many patients the author has seen who have been diagnosed erroneously by workers in other well-known institutions in many countries. For purpose of visualizing this statement reference is had to the case of a man, 59 years of age, who has had trouble in his right hip since childhood. The destructive changes of the femur and pelvic bone seen by other radiologists have been interpreted as "tuberculosis," "sarcoma" and "ostitis fibrosa cystica." At Kienböck's institute the diagnosis was changed to "bone echinococcus, cystic type" with the clinical note of "chronic, benign course, relatively little complaint, no suppuration." There are many such instructive cases in the two issues. Naturally, general surgeons and roentgenologists will be particularly interested in the issue dealing with the differential diagnosis of osseous growths. Whether one considers the skull or the rest of the osseous system one must admit that in spite of years of labor devoted to the pathology and diagnosis of their neoplastic diseases, many of the problems have not yet been fully solved. Again their diagnosis without the modern aid of carefully executed radiograms is in many instances impossible except when surgically removed structure has been subjected to microscopic investigation. Furthermore an extensive, all-inclusive work on bone tumors is still a desideratum. It is therefore gratifying that the author, who combines in his person not only an expert roentgenologist but a pathologist and diagnostician of enviable ability, has undertaken the task of giving the medical world a monograph that fills the gap above alluded to. Apart then from general procedures in a diagnostic sense, the first issue takes up primary osseous tumors, deformities of the skeleton with dysplastic growths, anaplastic tumors and malignant blastomas, cystofibroma, general cystofibrosis, myelogenous affections, multiple myelomas, myelosarcomas, lymphoepithelioma and tumor metastases. Each of these neoplasms is richly illustrated by excellently reproduced x-ray photographs and every phase and feature is pointed out with exactness and at great detail. With such a work anything the reviewer might add by way of comment would be inadequate to present the true value of this addition to clinicoroentgenologic diagnostics.

CHRONIC INTESTINAL TOXEMIA AND ITS TREATMENT, WITH SPECIAL REFERENCE TO COLONIC THERAPY. By *James W. Wiltsie*, A.B., M.D., Consultant in Physical Therapy at the Binghamton City Hospital, Binghamton, New York. Cloth. Pp. 268 with 8 illustrations. Price, $3.00. Baltimore: William Wood & Company, 1938.

For the first time, at least in America, the problem of colon lavage has been critically and lucidly reviewed by a physician widely recognized as one of the foremost students of the subject. Under the circumstance it is interesting to note that the author has dealt in the first chapter frankly and conservatively, incisively but constructively with this therapeutic problem to its greater advantage and hoped for recognition by the medical profession. In his attempt to appraise the factors provocative of the resistance toward this procedure, Wiltsie has reviewed all the available pro and contra evidence — its historic background, the controversial opinions, hasty evolution and misinformation; its abusive practice by lay and borderline practitioners; its exploitation for the credulous by the ignorant and self-seekers. The remaining chapters, fifteen in number, consist of comprehensive but critical discussions of the scope, indications and limitations of present methods of colonic irrigation for the sys-

drome of chronic intestinal toxemia. In a sense this volume is a record of this author's awakened interest in the problem because of the chaotic and paradoxical opinions held on the subject, and his search for the most scientific approach to the management of this much neglected clinical field. Considerable discussion has therefore been introduced in review of the relationship of food and bacterial allergy, focal infection, mechanical or anatomic complications and functional disturbances. A very lucid exposition of the anatomy and physiology of the colon forms the basis for the concise technic herein outlined and the common causes for failure. The conclusions reached by the author are that colonic irrigation in the hands of experienced physicians is an excellent aid to the drainage of the deeper tissues and a valuable means of restoring to normal function the colon, liver, lymphatics and cellular structures. An extensive reference (180) not only lends support to the author's thesis but reflects the painstaking effort to present the most authoritative literature related to the subject.

THE SYNOVIAL MEMBRANE AND THE SYNOVIAL FLUID. With Special References to Arthritis and Injuries of the Joints. By *David H. Kling*, M.D., Assistant Professor of Orthopedic Surgery of Arthritic Clinic, White Memorial Hospital, Los Angeles, California. Formerly Frederick Brown Research Fellow, Hospital for Joint Diseases, New York. Cloth. Pp. 299 with 80 illustrations and 34 tables. Los Angeles: Medical Press, 1938.

All interested in the scientific treatment of diseases and injuries of the articulations will welcome this rather unusual but timely contribution to a subject which has been treated both in medical schools and in the literature in stepmotherly fashion. Though at first blush it may seem that any detailed study of the synovial membrane and its fluid, say in arthritis, may smack of the theoretic if not pedantic in scientific medicine, there will be left no doubt after careful perusal of Kling's praiseworthy effort that his study has a decided bearing on the clinical problems with which we are often confronted. While some work of investigation concerning the behavior of the synovial membrane and fluid in disease has been carried out especially abroad before the present publication, the literature is hardly accessible to the average practitioner, and it is to Kling's merit that we now have a well-rounded monograph encompassing every aspect of the concerned problems. Thus the author opens his contribution, which contains much of his own original research, with a brief history, and this his first chapter is followed by several devoted to a thorough consideration of the anatomic and physiologic problems of all structures of and in the vicinity of joints, both normally and pathologically. The biologic problems of the synovial fluid are contained in the second part of the book through no less than 7 chapters, with the third part of 6 chapters taking up the special pathologic features of joint effusions. Finally the fourth and last part of 4 chapters develops a rational application of the fundamentals to actual disease, the text proper concluding with the technics of aspiration of individual joints and the necessary laboratory procedures. It is clear from the all too brief description of this book that it represents one of the most valuable additions to the pathology and clinic of a large variety of articular affections. No one interested in their treatment can afford to miss perusal and careful study of this small but weighty volume.

BEHANDLUNG DER OFFENEN BRÜCHE DER LANGEN RÖHRENKNOCHEN (mit einschluss der behandlungsergebnisse). Von *Dr. Walter Ehalt*, Oberarzt des Unfallkrankenhauses in Wien. Cloth. Pp. 361, with 604 illustrations and 95 tables. Price: Rm. 30. Vienna; Wilhelm Maudrich (American Agency: Chicago Medical Book Co., Chicago), 1938.

When one considers the large number of excellent text-books and monographs that have appeared both here and abroad on the ever interesting subject of fractures, one must indeed wonder why the publisher has ventured on the present enterprise. Perhaps the best answer is that this book has not the usual aspects of monographs on fractures in the sense of a representation of indications and technics, but actually is that and an exhaustive critical review of the results obtained in the internationally known accident hospital of the Austrian capital. There Professor Böhler has had the material for exhaustive study and development of his methods, and there his assistant has compiled the methods and their end results. In a foreword Professor Böhler points out that about 100 years ago no less than 50 to 60 per cent of cases of "open" or better stated "compound" fractures have perished, while under his uniform plan of management, which does away with chemicals and sera, out of 307 patients only one died of sepsis. Both technic and critical comparisons with reference to end results of these 307 cases embrace compound fractures of the long bones of the lower and upper extremities and contain too many details even for mere enumeration. The illustrations, both actual photographs and x-ray reproduction are superb, as indeed the format leaves nothing to be desired. To all interested in the management of fractures this book will present many new and valuable data.

RUSSIAN MEDICINE. By *W. Horsley Gantt*, M.D., Johns Hopkins University School of Medicine, formerly Chief of Medical Division, American Relief Administration, Leningrad Unit (1922-23); Collaborator in Pavlov's Laboratories (1925-29). Cloth. Price, $2.50. Pp. 214 with 12 illustrations. New York: Paul B. Hoeber, Inc., 1937.

This is the twentieth volume of a series of handbooks which under the general title of "Clio Medica" aims at presenting in a concise and readable form special phases of the history of medicine. The present history of medicine in Russia is of special interest as it leads up to Soviet Medicine and the last chapter gives a description of the determined attempt to create a socialized medicine in adaptation to the needs of the communistic population. Physical therapists will be interested to note that

hydrotherapy in Russia as elsewhere was part of its primitive medicine. In some regions of Russia today the Russian bath is the same as when it was described in 946 by the Novgorod annalist and by Nestor. The author gives the period of primitive medicine in Russia as continuing to the reign of Peter the Great. During this period of the low level of Russian culture foreign influences were not assimilated. The medical knowledge of this period was used only by the court. The people were treated by witch healers or treated themselves with baths, garlic, onions and similar remedies. The foundation of the Moscow Gofs Hospital and its medical school, the first in Russia, on May 25, 1706, marks the birth of Russian medicine. From then on Russia has contributed much to medical science. It is an interesting account, which merits widespread perusal.

THE RHEUMATIC DISEASES. Edited by *Sir Leonard Hill*, M.B., LL.D., F.R.S., Director of Research, St. John Clinic and Institute of Physical Medicine and Consultant to the Rheumatic Unit at St. Stephan's Hospital (London County Council), and *Philip Ellman*, M.D., M.R.C.P., Physician to St. John Clinic and Institute of Physical Medicine and Consultant Physician to the Rheumatic Unit at St. Stephen's Hospital. With a foreword by *Sir Arthur MacNalty*, K.C.B., M.D., F.R.C.P., Chief Medical Officer to the Ministry of Health. Cloth. Price, $4.00. Pp. 270 with 46 illustrations. Baltimore: William Wood & Co., 1938.

The subject of rheumatism is presented as a course of lectures arranged by the medical staff of the St. John Clinic and Institute of Physical Medicine. This institute is a post-graduate teaching center in physical medicine under the jurisdiction of the Order of St. John of Jerusalem where nearly 120,000 treatments are given annually principally by physical methods. The various contributors consider the etiology, the social and economic aspects, the classification of chronic rheumatic diseases, the acute rheumatic diseases in childhood, the pathology of the rheumatoid type of arthritis, nasal, pharyngeal and pelvic sepsis in relation to the rheumatic diseases, radiology in these conditions, non-articular rheumatic affections, rheumatic diseases of the spine, sciatic and brachial neuralgia, antistreptolysins and blood uric acid in chronic rheumatic diseases, and the medicinal orthopedic and surgical treatment of these conditions. There are also excellent chapters on the physical basis of medicine by H. J. Taylor the physiologic action of methods used in physical medicine by Sir Leonard Hill; the indications for light therapy by Albert Eidinow; the technic of local and general ultraviolet irradiation of the skin by Albert Eidinow; and hydrotherapy by Francis Bach. These lectures give an excellent idea of the work that is being done in the campaign against rheumatism in England, and present not only the results of research but what is more important the methods of prevention and cure. In the treatment of rheumatic diseases physical therapy plays a major role. Therefore this book should be read by all physicians interested in physical therapy.

THE CHICAGO RECREATION SURVEY. Volume I: Public Recreation; Volume II: Commercial Recreation. By *Arthur J. Todd*, Chairman, Department of Sociology and Anthropology, Northwestern University. In collaboration with *William F. Byron*, Chairman, Division of Social Work, Northwestern University; *Howard L. Vierow*, Director, Chicago Recreation Survey. Boards. Volume I, Pp. 268, Volume II, Pp. 167 with illustrations. Chicago, 1937.

This survey describes a project sponsored by the Chicago Recreation Commission and Northwestern University and conducted under the auspices of the Works Progress Administration, National Youth Administration and the Illinois Emergency Relief Commission. Volume I contains chapters on the planning and historical aspects of public recreation, its administration, financing, management, facilities, museums, forest preserves, facilities for golf and tennis, swimming, lagoons, harbors and public libraries. Volume II considers the licensing and control of commercial recreation, such as motion picture theaters, legitimate, concert and operatic theaters, billiard and bowling establishments, baseball, basketball, football, boxing and wrestling, commercial health clubs, gymnasiums and natatoriums, horse racing, riding, polo and horse shows, bicycling and automobile racing, golf and tennis, ice sports and roller skating rinks, rental libraries, sight-seeing tours, observatories, sight-seeing flights, excursions, annual shows, conventions, radio, newspaper promotion stunts, amusement parks, ball rooms, dancing schools, retail liquor establishments and commercialized vice. These contributions contain much of interest to social workers and those interested in recreational therapy.

INTERNATIONAL ABSTRACTS

Fever Therapy in Gonococcal Infections. J. A. Trautman, H. V. Stroupe, and D. J. Devlin.

Am. J. of Syph. Gonor. & Vener. Dis. **22**:53 (Jan.) 1938.

Fever sessions of five hours' duration have resulted in early and complete relief of pain and swelling in cases of acute epididymitis, acute arthritis, and acute prostatitis. The percentage of patients in whom a complete disappearance of gonococcal infection occurred was somewhat greater in acute gonorrhea than in chronic gonorrhea. In 278 patients who received fever therapy for gonorrhea, 225, or 80.94 per cent, completed a full course of fever treatments. By a complete course of fever is meant that the sessions were given at two or three day intervals until no evidence of further infection was found, or no additional improvement noted, or that a partially improved case had ceased to derive further benefit. Of these 225 patients, 130 had acute gonorrhea with or without complications. One hundred and thirteen (86.93 per cent) of the acute and 67 (70.52 per cent) of the chronic infections were apparently cured after completion of fever therapy. One death occurred as a direct result of fever therapy. This is a fairly low percentage when one considers that 2,597 treatments were given to 430 patients. The results in the few treated cases of ophthalmia, indicate that better reactions might be expected if treatment could be instituted early.

Fever Therapy in Cutaneous Disorders. A. B. Litterer, and K. Phillips.

Southern Med. J. **31**:339 (April) 1938.

Fever therapy was introduced in 167 cases of cutaneous diseases (eczematoid, erythema multiforms, psoriasis, endocrinopathies, urticaria and seborrheic dermatitis). In the eczematoid group a 96 per cent immediate response was obtained and this high improvement continued well into the fourth month of observation. Between this and the fourth year a relapse of 31.25 per cent was observed in those patients who received a complete clinical remission of their cutaneous lesions immediately after the course of fever treatments. The immediate response in the erythema multiforme cases revealed a complete resolution in 90 per cent, which again extended well into the fifth month. But over a period of two years there was a relapse ratio of 33⅓ per cent. Psoriasis revealed a 50 per cent immediate response, but within four years 33⅓ per cent had relapsed. The complete response of endocrine cases to fever therapy with complete abeyance of their cutaneous manifestations was 80 per cent. After four years there have been no relapses. Only a 62.5 per cent immediate response was obtained in urticaria and 60 per cent of these relapsed. In addition to these eighty cases, a group of seventy-five has been studied over the last seven years with reference to the part played in the etiology by underlying systemic conditions. In more than 90 per cent there can be demonstrated by thorough study abnormal upsets in one or more of the gastrointestinal, liver and biliary or endocrine systems. When these conditions are isolated and the treatment consists of correcting them in addition to fever therapy, the immediate response promptly rises to 85 per cent and the relapse ratio drops to 25 per cent. So successful has this combined management been that the authors have practically discontinued cutaneous testing and attempted desensitization in urticaria. The results are decidedly encouraging and justify further investigation. Much light is thrown on the mechanism of both the etiology and the response of these cutaneous disorders by a study of physiologic and biochemical changes already established during fever therapy. The two great regulators of body temperature balance in normal man are the heat regulating mechanism in the brain base and the proper function of the skin. Temperature changes at the base of the center of the brain invoke an immediate reflex response in the circulation at the surface with an associated fluctuation in the elimination of water and crystalloids through the excretory ducts. — [Abstr. J. A. M. A. **110**:1875 (May 28), 1938.]

Low Back Pain. Louis C. Jensen.

Med. Bull. Vet. Admin. **14**:345 (April) 1938.

Treatment of low back pain varies according to the types encountered and may consist of a selection or combination of mechanical, surgical, and medical measures. For postural correction, rest and corrective exercises are advocated. This may be supplemented by physical therapy and by back support such as belt or brace. Correction of short leg is made by employing a lift or raise of heel or sole of shoe. The type of brace or support varies from a wide sacroiliac belt to the Osgood type of brace, having auxiliary crutches to take the weight off the iliac crests. The brace most frequently used is the spring-steel device of Goldthwaite. Treatment of traumatic cases, e. g., acute and chronic low back sprains or strains, is largely mechanical. It requires rest and partial or complete immobilization of the back. Heat and sedatives may be necessary in acute cases, but in chronic conditions the usual measures are manipulation under general anesthesia, application of a cast or a plaster of Paris jacket, immobilization and rest,

the employment of massage and rehabilitating exercises. A fusion operation may be necessary in some cases as a last resort.

Patients with diseases, toxic or otherwise, of the lower spine, require a combination of treatment—medical, orthopedic, and eradication of foci of infection. In acute arthritis, rest is important. In chronic arthritis, cabinet baths and exposure to infra-red or other powerful lights may be used. Massage is beneficial in many cases. Often partial immobilization with a suitable brace is called for. Heliotherapy has been employed in conjunction with other forms of treatment. A fusion operation may be necessary as a last resort in long-standing cases.

Shock in Therapeutic Hyperpyrexia. I. Kopp, and H. C. Solomon.

Arch. Int. Med. **60**:597 (Oct.) 1937.

Kopp and Solomon made a study of the severe reactions, considered as shock, that occurred in 8 patients during hyperpyrexia induced by hot, moist air. These patients were from 19 to 56 years of age. Death resulted in two of this group. The reactions occurred at temperatures of 106 F. or above, the body temperature usually showing some further rise during the reaction. The impending shock was ushered in by a sudden increase in the pulse rate, pallor or cyanosis of the skin, a continued or rapid rise in the body temperature, fluttering of the eyelids, twitchings of the muscles of the face or extremities, vomiting or sudden quietness, suggesting coma in a patient who had previously complained bitterly of the heat. Readings of the blood pressure when obtained at this time showed low levels and in three patients the radial pulse was either weak or absent. The pulse rate at the onset was usually rapid. In one patient it increased from 130 to 180. In 6 patients these initial symptoms were followed by clonic or tonic convulsive movements of the jaw, extremities or trunk, and in 5 of the latter group the rigidity, either localized or generalized, was so marked that it was difficult to differentiate it from the tonic state of a convulsive seizure or muscular rigors due to heat cramps. In all patients considerable hyperactivity, jactitation and maniacal excitement occurred, and it was necessary to restrain them. This episode was either preceded or followed by coma or delirium or both. Clinical signs of pulmonary edema were present in 3 patients. The skin of each patient was hot and dry. Sodium amytal or morphine sulfate was administered to five patients of this group before or during fever therapy. Six patients survived the treatment, 5 recovering completely in from one to forty-eight hours, with no residual changes or complaints. The sixth patient experienced a stormy convalescence of eight weeks. The mechanism of shock under the conditions of hyperpyrexia consists of a diminution in the blood volume, an increase in the vascular bed and an increase in the vascular permeability. A disturbed neurogenic mechanism, in addition to a disturbed hematogenic mechanism (dehydration), is also present. Alkalosis and hypochloremia during artificial hyperpyrexia modify the clinical picture of the shock syndrome. Treatment should attempt to reduce the body temperature, increase the volume of blood, diminish the capillary permeability and compensate for the alkalosis and the loss of chlorides by evaporation of lukewarm water from the surface of the body, intravenous infusions and inhalations of carbon dioxide and oxygen. — [Abst. J. A. M. A. **109**:1850 (Nov. 27), 1937.]

Surgical Treatment of Detachment of the Retina. J. Cole Marshall.

Lancet **234**:1033 (May 7) 1938.

The patient is put to bed for two or three days before operation to allow careful examination of the eye under standard conditions. The meridian of the tear is marked with India ink on the corneoscleral junction, as this leads to greatly increased accuracy of technic. A general anaesthetic is unnecessary. Omnopon gr. ⅓ and scopolamine gr. 1/150 are administered an hour before operation. In this way, some degree of cooperation by the patient is retained.

The position of the tear is surrounded by diathermy punctures 2 ma. apart and these punctures may be carried back to the ora in suitable cases. Before or after the application of diathermy, localization is checked by the introduction of the 3 mm. electrolytic needle for 1 sec. and examination of the vitreous for the presence of bubbles. Should the localization be accurate, the inter-retinal fluid is then drained by repeated punctures with a 1.5 mm. electrolytic point (current 3 ma.). If sufficient fluid does not appear, a thicker needle may be used, or perforation by a longer diathermy point or even a galvanocautery. When the latter is used, a circle of superficial cauterization is made, through the center of which the cautery is plunged. Repeated ophthalmoscopic examination should be made during the operation and, for this purpose, a sterile cotton gauntlet is used when holding the instrument. Finally any divided muscle is sutured and the conjunctival edges brought into accurate position. Catgut sutures are used throughout. Atropine 1 per cent, and argyrol 20 per cent, are instilled and both eyes are bandaged, a metal shield being placed over the operated eye.

Electrosurgery in Combination With X-ray and Radium in the Treatment of Surgery. William H. Schmidt.

Med. Rec. **148**:527 (June 15) 1938.

Schmidt points out the value and limitation of classic and electrosurgery in deep or accessible neoplastic diseases as well as the type of x-ray and radium suitable to certain conditions. The fact that tumors are either radio-sensitive or resistant, deep or superficial, speaks for a selection

of method only appreciated by the surgeon who has special experience in the management of malignant disease. The author stresses the value of each procedure, its combination with radiotherapy or its special selection in certain growths or locations. Thus it is recommended that electrosurgery is suitable for ablation of neoplasms about the face and upper lip, low voltage x-ray for near surface tumors, high voltage for deep seated or inaccessible lesions or metastatic or diffuse growths. In general, the author places greatest reliance on the electrothermic method in lesions about the face because it will destroy tissue under absolute control as to depth and width and produce no deleterious effect upon the surrounding normal tissue. It is moreover more certain because it can eradicate the growth at once as a dead mass; whereas radiation is uncertain, more costly and more time consuming without greater assurance of results.

Transvesical Diathermy in the Treatment of Carcinoma of the Bladder. Alexander Randall, and Charles A. W. Uhle.

Surg., Gynec. & Obst. **66**:927 (May) 1938.

Transvesical electrosurgery is of value in the treatment of lesions involving only the basal regions of the bladder and those not amenable to bladder resection or to transurethral management. The therapy of vesical carcinoma should be selective. The attained operative mortality of 9.8 per cent indicates its safety. The three most serious complications of surgical diathermy are the establishment of fistulous communication between bladder and rectum or vagina, acute pyelonephritis, and chronic pyelonephritis. Fistulas can be prevented by curbing the overzealous application of the high frequency current. There was only one fistula (vesicovaginal) in the authors' series. The incidence of acute pyelonephritis can be reduced by the introduction of a ureteral catheter for drainage at the conclusion of the operation if the operation was directly over, or in close proximity to, the ureteral orifice. Stenosis of the ureteral orifice secondary to healing fibrosis may be a later manifestation. Renal morbidity (chronic pyelonephritis) can be lessened by follow-up periodic ureteral dilatation. Diathermy produces an aseptic necrosis. If infection supervenes the progression of pathological events ranges from the simple to the fulminating type with pelvic cellulitis, pelvic phlebitis, and death. Cicatricial reaction following diathermy does not produce marked vesical deformity. In spite of extensive diathermy, scarring if often minimal, and in 47 per cent of patients vesical comfort and silence can be acquired. There was a general mortality of 56.8 per cent. Death was ascribed in this group to recurrence of the growth with secondary renal infection and uremia. Other contributory factors were distant metastases, unhealed suprapubic sinuses, and septicemia. Cordotomy was performed in one case for relief of intractable pain. No evidence of recurrence, irrespective of the time limit of follow-up, was found in 35.3 per cent. Recurrent growths developed in 43.1 per cent. Routine cystoscopy, after operation, is of great importance in detecting early or late recurrences. In one instance a papillary recurrence was found 74 months after the original operation. Cystoscopic fulguration is sufficient to effect control. The importance of an efficient follow-up service cannot be overemphasized. Ten patients, 19.6 per cent, were followed from 40 to 86 months. Four had recurrences and 6 were free of recurrence.

Artificial Fever for Gonococcic Infections in the Male. Stafford L. Warren; Winfield W. Scott, and Charles M. Carpenter.

J. A. M. A. **109**:1430 (Oct. 30) 1937.

When a pure culture of the gonococcus has been isolated from the specimen submitted for bacteriologic examination, the thermal death time of the strain is determined. Observations have indicated that 41.5 C. (106.7 F.) is the highest temperature the body can safely tolerate for intervals of from 8 to 24 hours. The duration of the period of fever is based on the thermal death time of the individual strain of the gonococcus at this temperature. Sealed glass vials containing from 1.5 to 2 cc. of a dextrose-ascitic fluid-blood broth culture of the gonococcus are immersed in a constant temperature water bath set at 41.5 C. A vial is removed at hourly intervals and its contents are cultured for viability. The hour after which no growth occurs is considered to be the thermal death time. Experience has shown that it is unnecessary to make routine hourly observations except from the eighth to the twenty-fourth hour after the immersion of the culture in the bath. Examinations made on 250 strains of gonococci have shown that the thermal death time at 41.5 C. varies from 6 to 34 hours. The isolation of the gonococcus from the patient and the determination of its thermal death time require from seven to ten days. If contamination occurs during the examination, the procedure must be repeated.

There are several contraindications to the use of fever for gonococcic infections. Patients with electrocardiographic evidence of myocardial damage or heart block of any degree do not tolerate such therapy well. Mild valvular damage with full compensation, however, is not necessarily a contraindication in patients under 30 years of age. Patients more than 40 years of age should not be treated for 15 hours or longer unless a careful study is made of the cardiovascular system and especially of the peripheral circulation. Patients with chronic alcoholism should not be treated. Nonalcoholic patients occasionally show signs of toxemia from a gonococcic infection such as pallor, restlessness, anorexia, insomnia, marked sinus arrhythmia and dyspnea on exertion. It is also important to exclude those rendered susceptible to heat prostration by a low salt intake during the summer months or by acute

respiratory infections, and especially those with active pulmonary tuberculosis.

Fever therapy is indicated in those cases in which other types of therapy have proved of no value. It may well be considered in cases that fail to respond to the usual general and local therapeutic measures. Fever has proved a valuable asset in the treatment of the various complications resulting from gonococcic infections.

The Treatment of Sinusitis by Radiotherapy. W. Annandale Troup.

Brit. J. Phys. Med. 1:158 (May) 1938.

The ultrashort wave electrodes are applied opposite the affected sinuses. In the case of antral infection they should be directed upwards so as to include the ethmoidal, sphenoidal and frontal sinuses. The first treatment should not last more than ten minutes and subsequent treatments should not be increased by increments of more than five minutes; this will entirely depend on the reactions of the patient. The maximum duration of short wave treatment should be thirty minutes. On the other hand infra-red irradiation, if this is preferred, should be applied for at least half an hour, otherwise a therapeutic effect will not result. The patient should be advised that as a rule both these forms of treatment should result in an increased amount of post-nasal and nasal discharge with relief of headache and neuralgic pains. Troup is convinced that he obtained as good results with infra-red irradiation before the days of ultrashort wave as he did since he acquired a six metre short wave apparatus. Ultrashort wave therapy is perhaps more useful in reaching an infected ethmoidal region with its ramification of cells than other thermal agents.

Subvesical Diathermy Prostatectomy. R. Ogier Ward.

Brit. Med. J. 4046:175 (July 23) 1938.

If this technic, which may be called subvesical diathermy prostatectomy or prostatic resection, is employed it will be found that hemorrhage is less than with the older method, and that it is more easily controlled. Sepsis is also much diminished, owing to the fact that the trigone is left almost entirely intact instead of being mutilated. One complication which is unavoidable when this new type of diathermy loop is employed is that the pieces resected are often too large to wash out through the resectoscope, and it becomes necessary to recover them at the conclusion of the operation by aspiration, using the bulb of a Bigelow's evacuator attached to the sheath of the resectoscope by a short metal adaptor, or by grab forceps. Since larger pieces are cut away by these loops than by those of the original type it is possible to work through a smaller sheath, and one of 26 Charriere scale will be found very efficient. The risk of damage to the urethra is thereby lessened.

Faradic Current: Technic, Application and Clinical Indications. A. P. Cawadias.

Brit. J. Phys. Med. 1:166 (May) 1938.

The faradic current is an extremely valuable adjunct in habitual constipation. The electrodes are placed at the front and back, the digestive organs thus being in the path of the current. It should be remembered, however, that the current applied by this means does not really pass through the viscera. Although faradic and low-voltage currents may travel through the abdomen, whatever current passes is so likely to seek out the fluids that are good conductors that we cannot obtain anywhere a density sufficient for direct stimulation of the intestinal muscles. A large moistened pad electrode (4"x6") is placed over the abdomen, and another of equal size directly opposite over the back. The faradic current, usually surging, is passed in gradually increasing strength until definite contractions of the abdominal wall are evident. It is advisable to synchronize these contractions with the rate of respiration, producing about eighteen to twenty contractions per minute. The current may be increased during successive treatments.

Sterilization of Air in Operating Room With Bactericidal Radiation. Deryl Hart.

J. Thoracic Sur. 7:525 (June) 1938.

During the past fifteen months Hart has performed 132 individual stages of extrapleural thoracoplasties on 59 patients in a field of air sterilized by means of bactericidal radiant energy. The improvement in clinical results brought about by sterilization of the air with bactericidal radiation showed a favorable effect on (1) mortality, (2) infection, (3) postoperative temperature elevation, (4) duration of elevated temperature after operation, (5) wound healing, (6) general reaction of the patient, (7) changes in the operative procedure. Sterilization of the polluted air has closed the greatest remaining source of contamination of clean operative wounds. Contamination along the skin sutures and from infected perspiration must be carefully guarded against, particularly where the wound is to be reopened.